

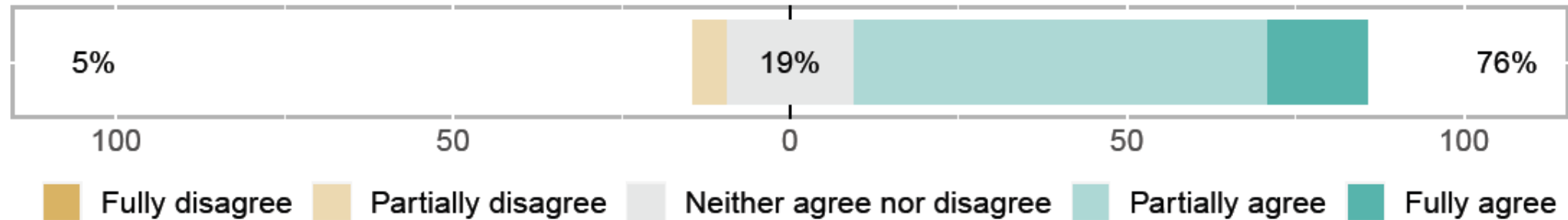
Giving appropriate feedback in primary programming education



Study on Challenges

(Sub-) Category	Themes
School	organisational media equipment, funding, internet connection
Students	
cognitive	prior media experience, overwhelming, reasoning, literacy, subject knowledge
affective	interest and motivation
heterogeneity	prior media experience, interest, subject knowledge, gender
metacognitive	distractability, concentration, impatience
young age	
Teachers	
cognitive	subject knowledge, overwhelming, prior media experience
didactic	individual support, child-friendly implementation, prevention of distraction
affective	self-efficacy
Programming	
complexity	programming language, technical terms, abstract, relation to life
problems	debugging
Government	
organisational	time, curriculum
Parents	
organisational	media equipment
affective	fear and criticism

Automatic analysis tools can support teachers with giving feedback to their students.



Chair of Software Engineering II and department of computer science education



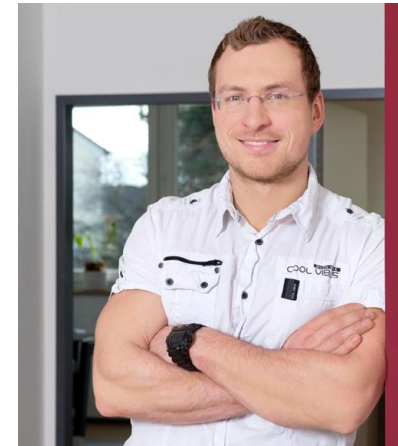
Prof. Dr. Gordon Fraser



Isabella Graßl



ADin Ute Heuer



Ewald Wasmeier



Luisa Greifenstein

Tool

- Static code analysis tool
- <https://scratch-litterbox.org>

Upload Project

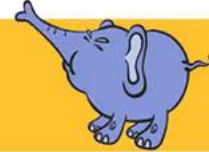
Teachers

Pattern

Old Analysis

About Litterbox

English



Codemuster

Bugs

Smells

Perfumes

ABS  Ambiguous Custom Block Signature

APNI  Ambiguous Parameter Name Used

BIE  Blocking If-Else

CWD  Call Without Definition

CL  Comparing Literals

CBF  Custom Block With Forever

CBT  Custom Block With Termination

ER  Endless Recursion

ETC  Expression As Touching Or Color

FIL  Forever Inside A Loop

IPD  Illegal Parameter Defector

MCC  Missing Clone Call

MCI  Missing Clone Initialization

MEA  Missing Erase All

MI  Missing Initialization

ML  Missing Loop

MPD  Missing Pen Down

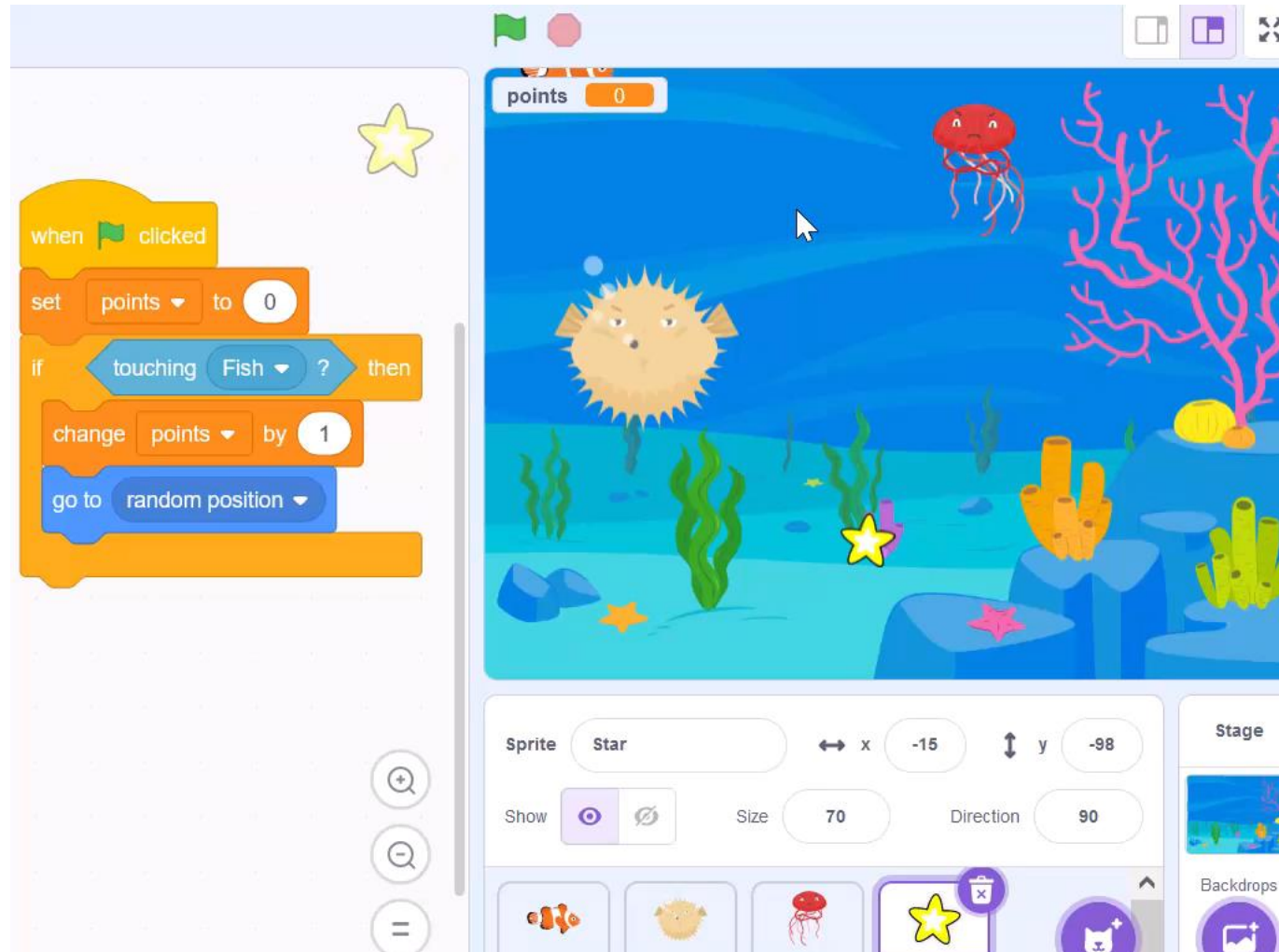
MPU  Missing Pen Up

MR  Missing Resource

MT  Missing Termination

MWC  Missing Wait Until Condition

NWS  No Working Script



The image shows a Scratch project titled "LitterBox" with a blue ocean background. A score variable named "points" is set to 0. The script area contains the following code:

```
when green flag clicked
  set points to 0
  if touching Fish ? then
    change points by 1
    go to random position
```

The stage features a sunfish, a jellyfish, coral, and a star sprite. The star sprite is currently at x: -15, y: -98, with a size of 70 and a direction of 90. The sprite palette at the bottom shows a star selected.



Upload Project

Teachers

Pattern

Old Analysis

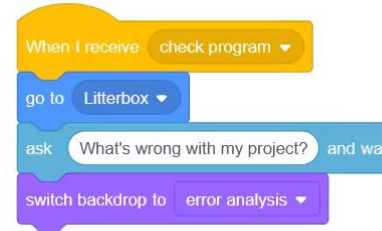
About Litterbox

English ▾



Welcome to LitterBox! LitterBox can help you find problems in your Scratch programs.

Simply upload your Scratch file or specify the path to your project. You'll then receive detailed information on possible errors in your program.



Your project file



Durchsuchen... Keine Datei ausgewählt.

Choose a file from your hard drive.

Project URL



https://scratch.mit.edu/projects/

Your age

Please choose your age (optional) ... ▾


Your gender

What is the purpose of your program but doesn't work?

(optional)

Possible bug in sprite **Star**: **Missing Loop**

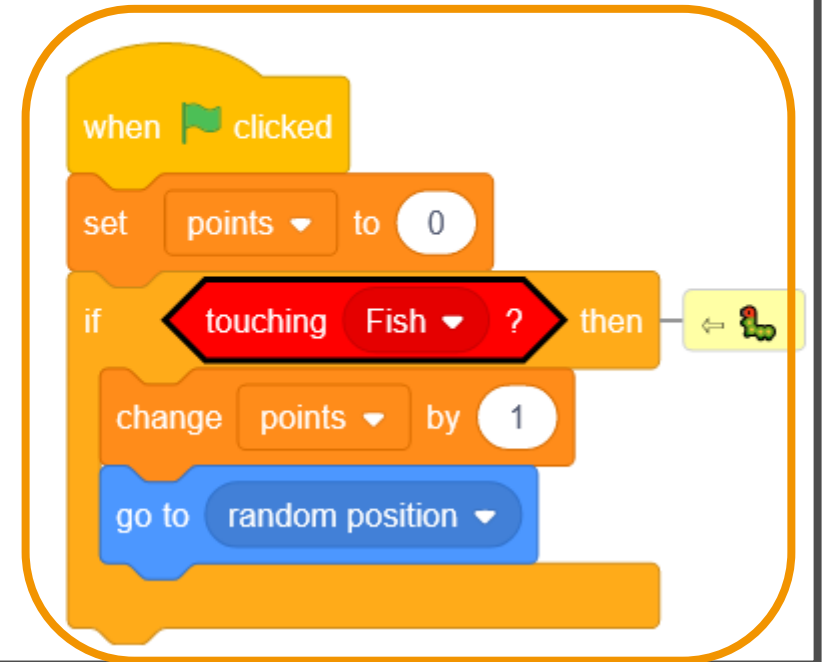
The highlighted event in the script is only checked once. The script is ending too fast.

Enclose the event with the block  to continuously check for the event.



Feedback on

- Mistakes
- Concepts
- Procedure

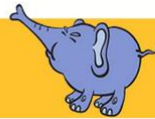


```
when green flag clicked
  set points to 0
  if touching Fish ? then
    change points by 1
    go to random position
```

What could the LitterBox tool be useful for?



Study on Debugging



FAQ

Aufgabe 3

Happy New Year



Julia

Hallo Frau Test, mein Programm funktioniert irgendwie nicht.


Ich möchte eine animierte Neujahrskarte erstellen:

Sobald man auf die grüne Flagge klickt, wird ein nicht sichtbarer Countdown gestartet. Der Countdown dauert immer unterschiedlich lange, der Computer denkt sich also sozusagen selber den Countdown aus.

Es ploppen viele bunte Luftballons auf. Sobald der Countdown um ist, wird das Jahr geändert.

Es klappt aber noch nicht, dass das Einhorn - sobald das aktuelle Jahr 2021 ist - "Frohes neues Jahr" sagt und vergrößert wird.

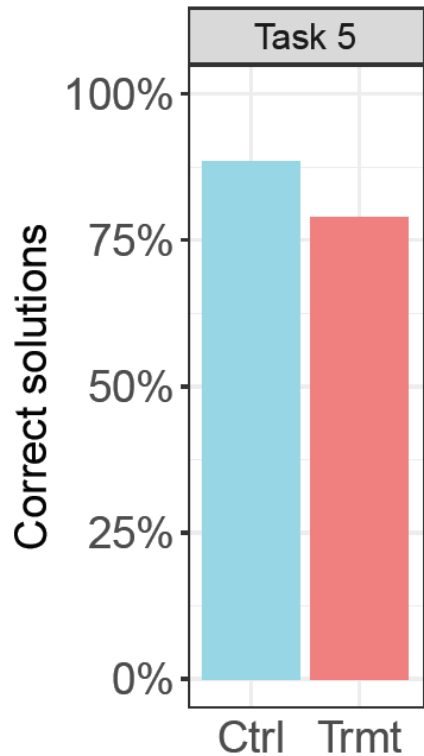



Tasks 1-7	Tasks 8-14
7 bug patterns	Same 7 bug patterns
Group Control (Ctrl): no hints Group Treatment (Trmt) :  hints	All: no hints
→ Performance	→ Learning



* significant difference

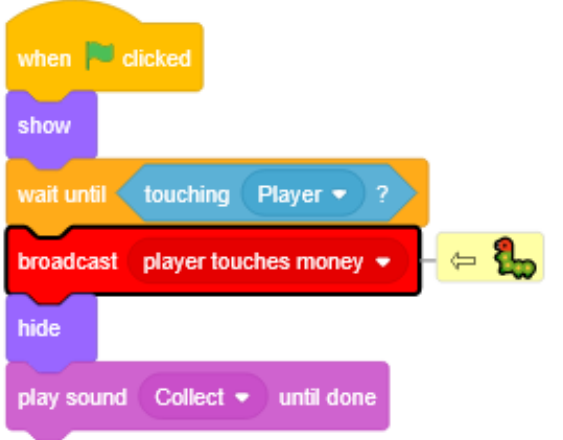
Hint for “Message Never Received”






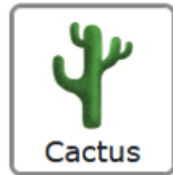
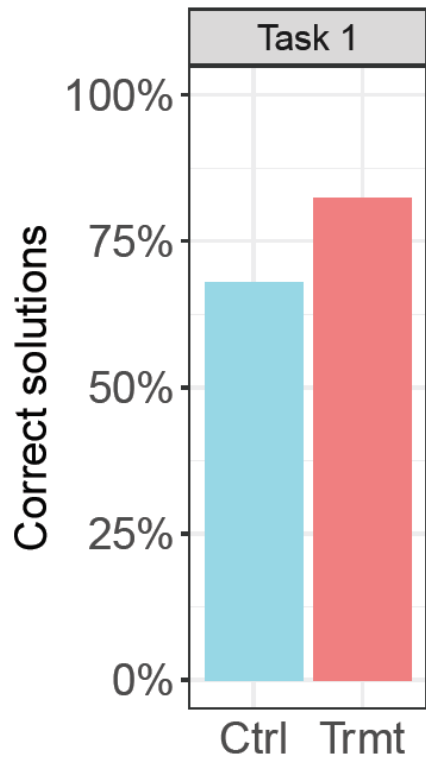
Possible bug in sprite Coins: Message Never Received

The message `player touches money` that is sent here is never received by a `when I receive player touches money` block. Therefore nothing will happen as a reaction to this message. When you send a message make sure that **another script** receives it.



“The bug has to be fixed in the sprite ‘Girlfriend’ and not in the ‘Coins’ – hence a somewhat misleading hint.” (T41)

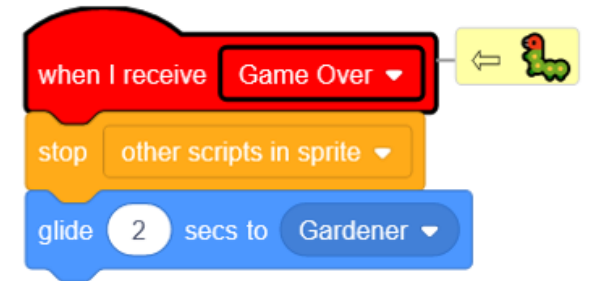
 Location where the bug has to be repaired



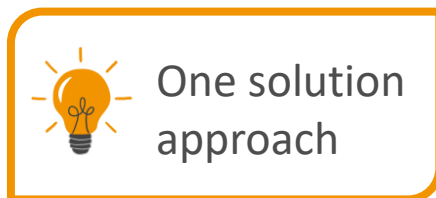
Possible bug in sprite **Cactus: Message Never Sent**

The message **Game Over**, that is supposed to be received is never sent. Therefore the script will never be triggered. If you want to receive a message,

- 1 you have to select a message that is being sent in a **different script**,
- 2 or create a new message to send in a **different script**.

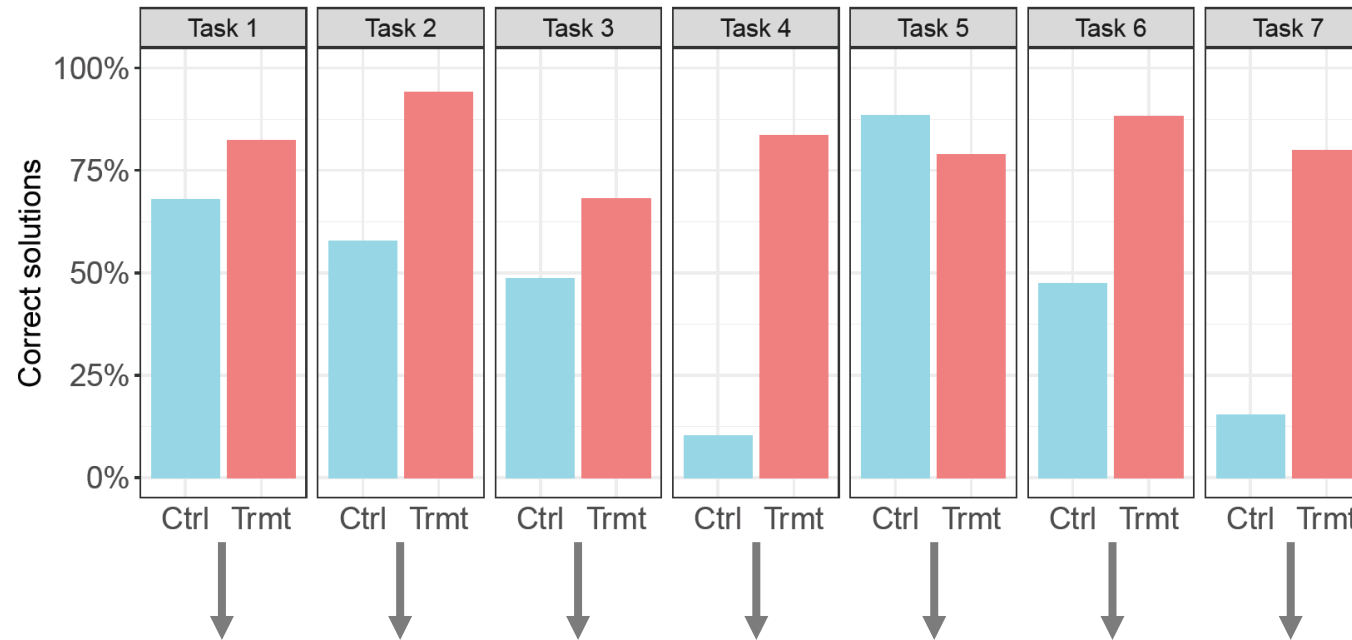


“I didn't know exactly what to do. Instead of ‘Game over’, I added the gardener's message ‘Ouch’.” (T19)



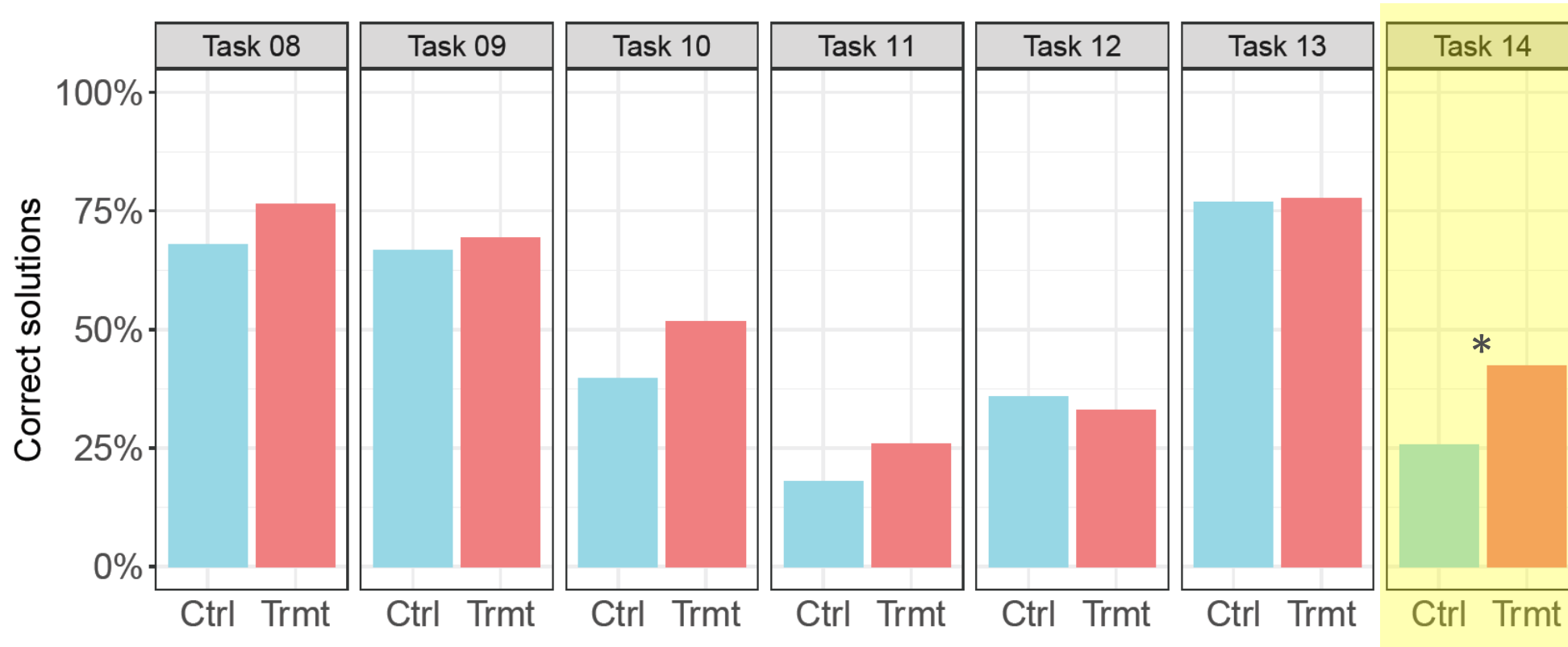
Transfer of tasks 1-7 to 8-14

Performance



Learning










* significant difference

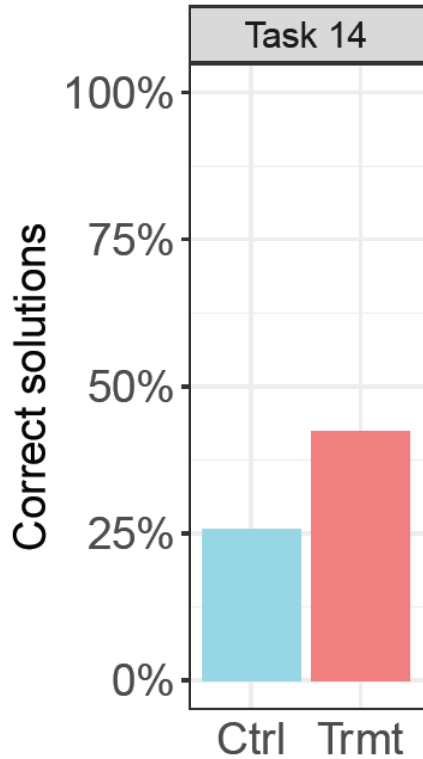
Task 7



Possible bug in sprite **Spaceship: Stuttering Movement**

If you press a key for longer, you expect a constant event processing. Unfortunately there is a delay between the first and second round of processing, making the movement stutter. You

can prevent this delay by using the block  from the sensing category in scratch. To do that you have to put the conditional  block inside of a  block and use the event handler  instead of using the event handler .



“With the step by step instructions I was able to repair the bug in an easily understandable way.” (T50)



Detailed information about how to remove the bug



Location where the
bug has to be repaired



One solution
approach



Detailed information about
how to remove the bug

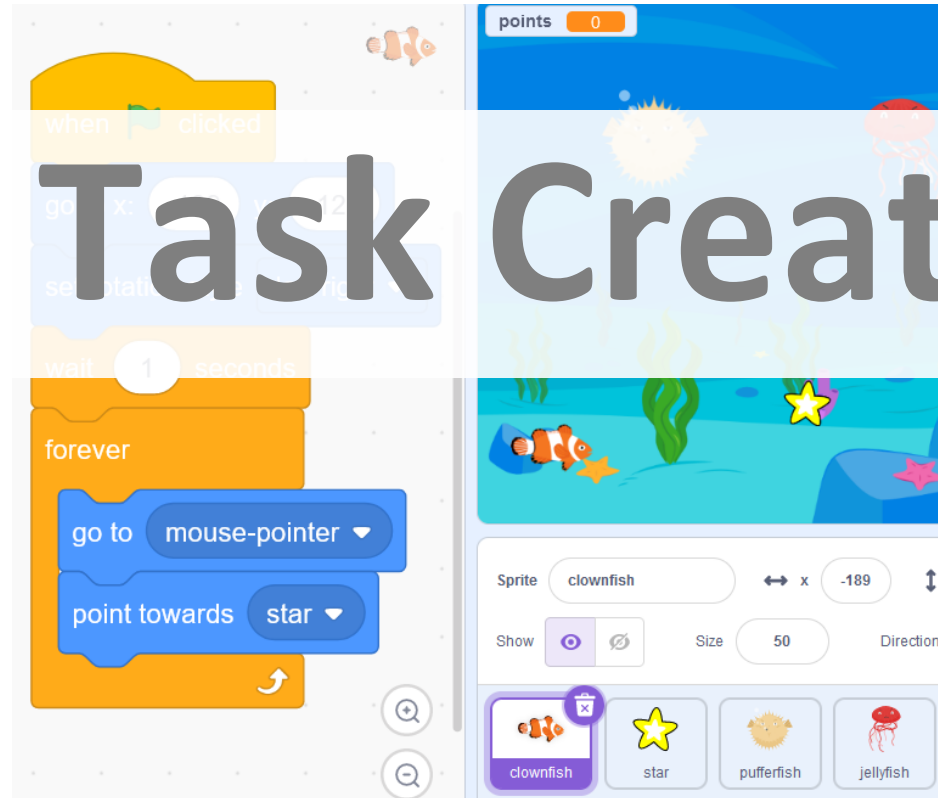
Sternenjagd

In dieser Aufgabe erweiterst du ein Programm.

- Offne Scratch
- Klicke auf „Datei“ und „Neues Projekt“
- Offne den Ordner „Dateien“ und klicke auf die Datei „Sternenjagd“.
- Erweitere das Programm.
 - Ändere, dass man zwei Punkte bekommt, sobald der Stern den Fisch berührt.
Momentan wird in der Figur „Stern“ nur 1 Punkt gegeben.
 - Das Spiel soll enden, wenn der Kugelfisch berührt wird.
Schau in die Figur „Qualle“. Dort funktioniert das bereits.
- Teste dein Spiel und kreuze an, was funktioniert.
 - Du bekommst nun für jeden gesammelten Stern 2 Punkte.
 - Das Spiel endet, wenn der Kugelfisch oder die Qualle berührt wird.

Diese Aufgabe wurde im Rahmen des Seminars „Algorithmisches Denken (primary: programming)“ an der Universität Passau erstellt.
Bildquellen: Scratch; Inhalt: Lösungsmuster „Berührungen abfragen“

Study on Task Creation



The image shows a Scratch code editor on the left and a game preview on the right. The code includes:

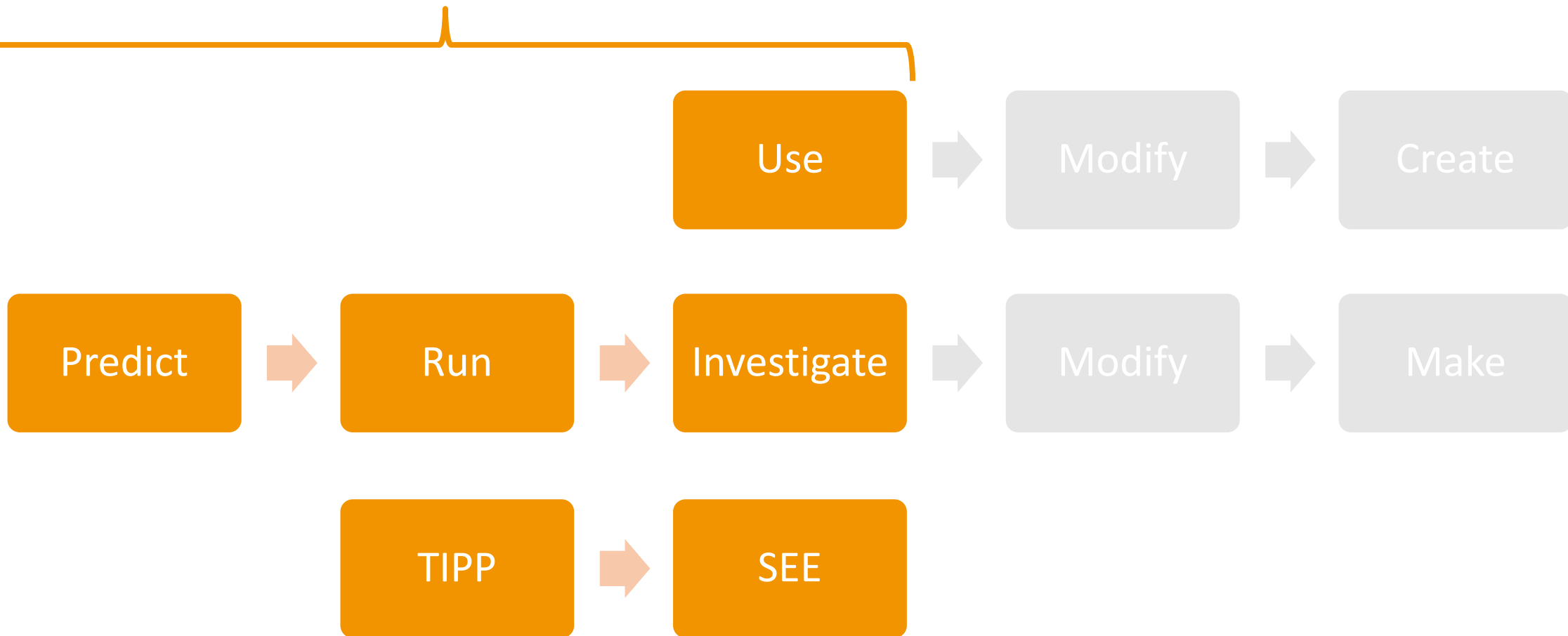
- when clicked: go to x: 12, set state to 1, wait 1 seconds.
- forever loop: go to mouse-pointer, point towards star.

The game preview shows a clownfish sprite with a score of 0, a star, a pufferfish, and a jellyfish on a blue background.

Group Treatment:



given program



Positive	No significant influence	Negative
<ul style="list-style-type: none">• Fewer code smells and bug patterns	<ul style="list-style-type: none">• Procedure• Time• Program size• Code Perfumes• Task type• Number of subtasks• Topics	

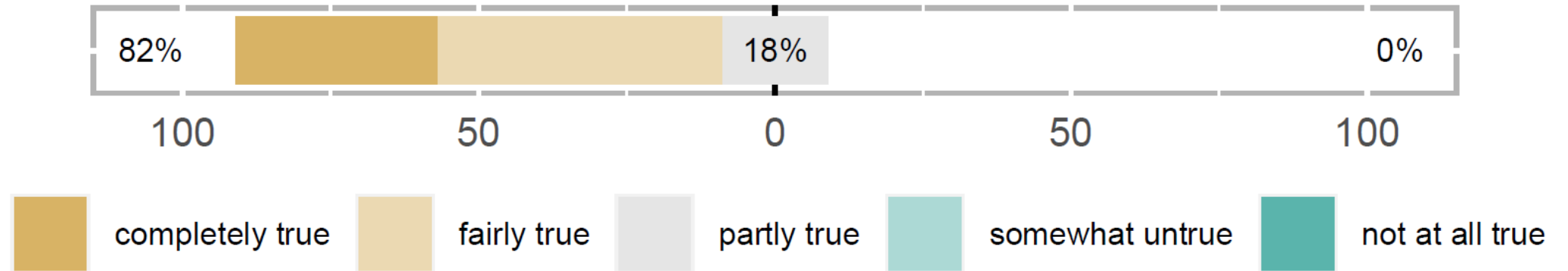
ausgang .

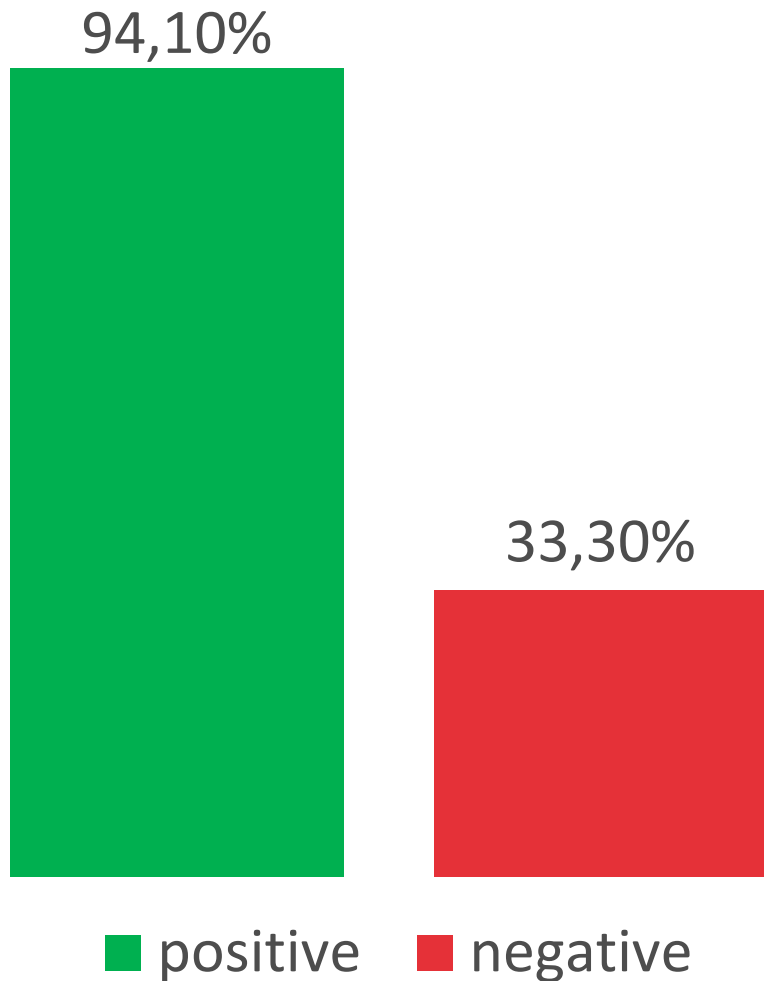
4 Erweitere das Programm.

- a) Ändere, dass man die Tänzerin auch nach rechts bewegen kann.
💡 Momentan kann die Figur nur in eine Richtung gesteuert werden. .
- b) Wenn die Tänzerin anfängt zu singen, sollen Luftballons in zwei Farben fliegen..
💡 Schaue in die Figur „Ballon1“.
💡 Denk an das behandelte Thema des „Kostümwechsels“

- Starting point
- Inspiration
- Sprite selection

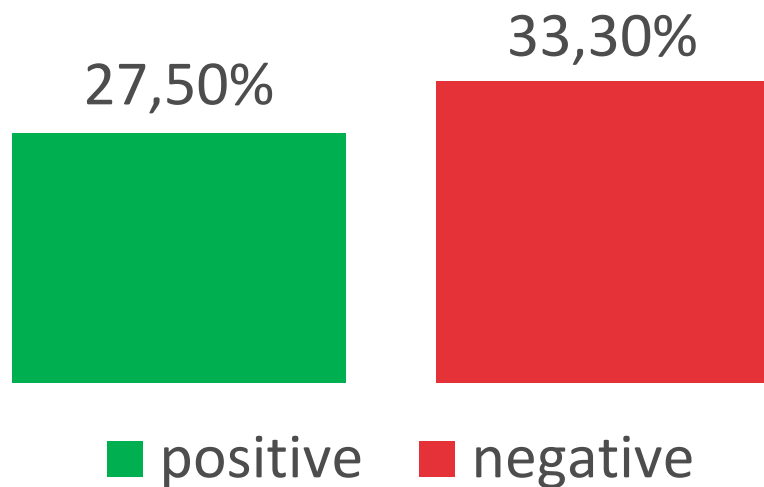
LitterBox can help teachers to create good example programs.





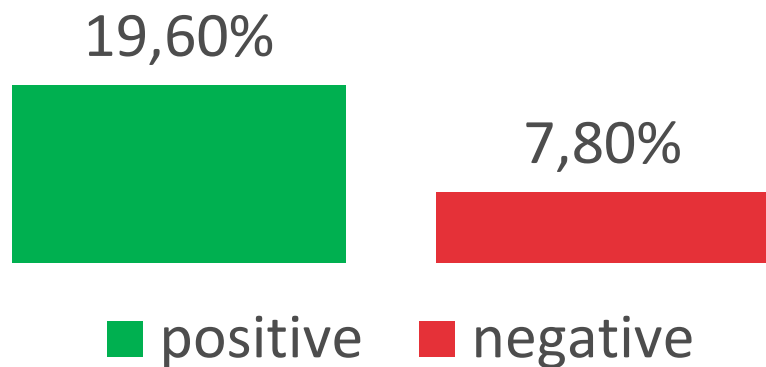
😊 *“Bugs are displayed so that it is easier for inexperienced teachers to identify and correct the sources of bugs.” (T82)*

😞 *“Unfortunately, you can't just say the tool something like ‘how do I make the frog stick its tongue out to the left whenever it looks to the left [...]’ (T64)*



😊 *“The great thing is always the pictorial representation.” (T2)*

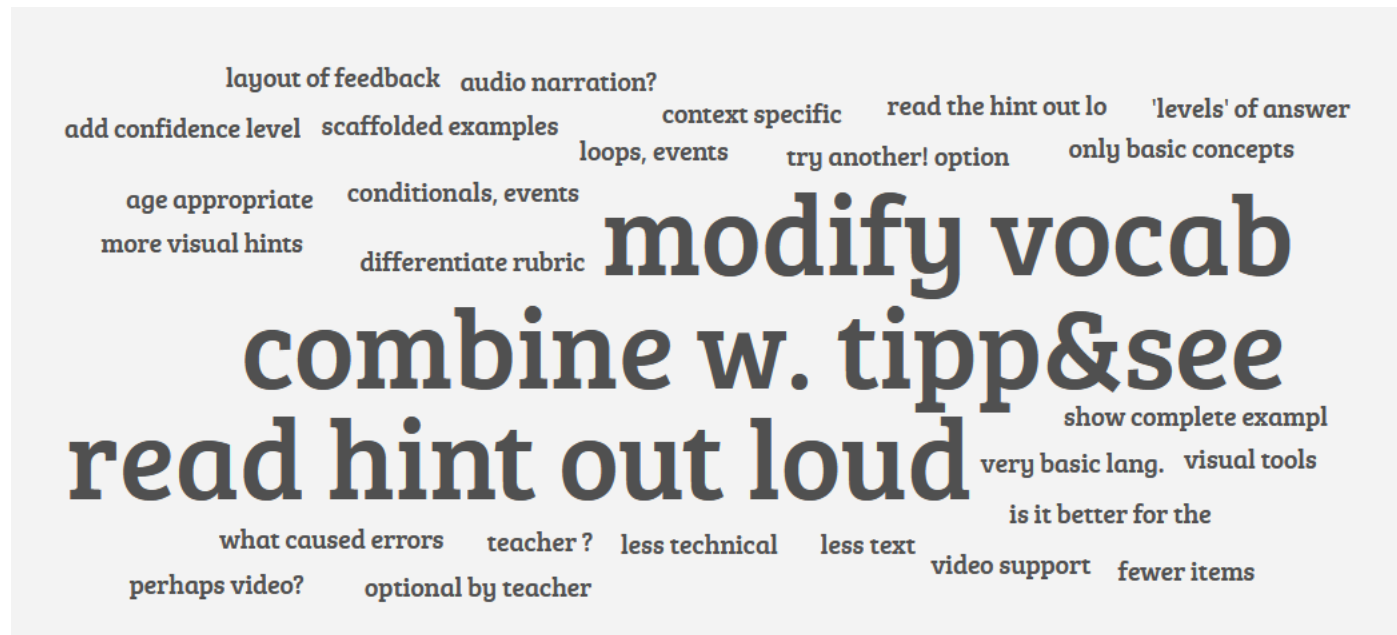
😞 *“There could be more detailed explanations.” (T69)*



😊 *“It can promote student understanding and a sense of achievement without the teacher's help.” (T3)*

😞 *“As a primary school student, Litterbox would probably seem too overwhelming so it is only useful for the teacher.” (T67)*

What aspects of LitterBox hints should be adapted for children?




Study on Hint Content

Hint on mistake

Conceptual hint

„Sun Pong“ (Bug in the sprite „Racket“)

 Mark important words.

Explanation:

You can write something into the white fields of the blocks or insert other blocks.
Only if you insert the block of a variable, you get its value.

Hint on mistake

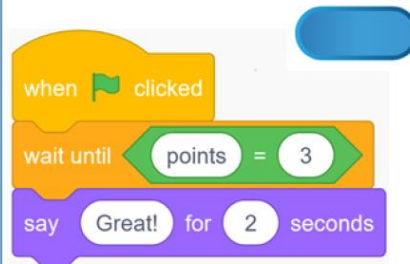
Procedural hint

„Sun Pong“ (Bug in the sprite „Racket“)

 Mark important words.

Procedure:

① Find the **buggy script**:



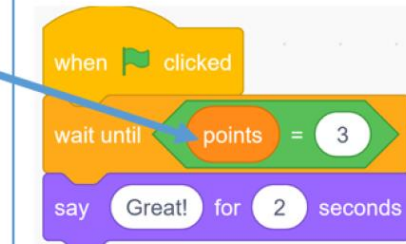
②

a) Insert this block:

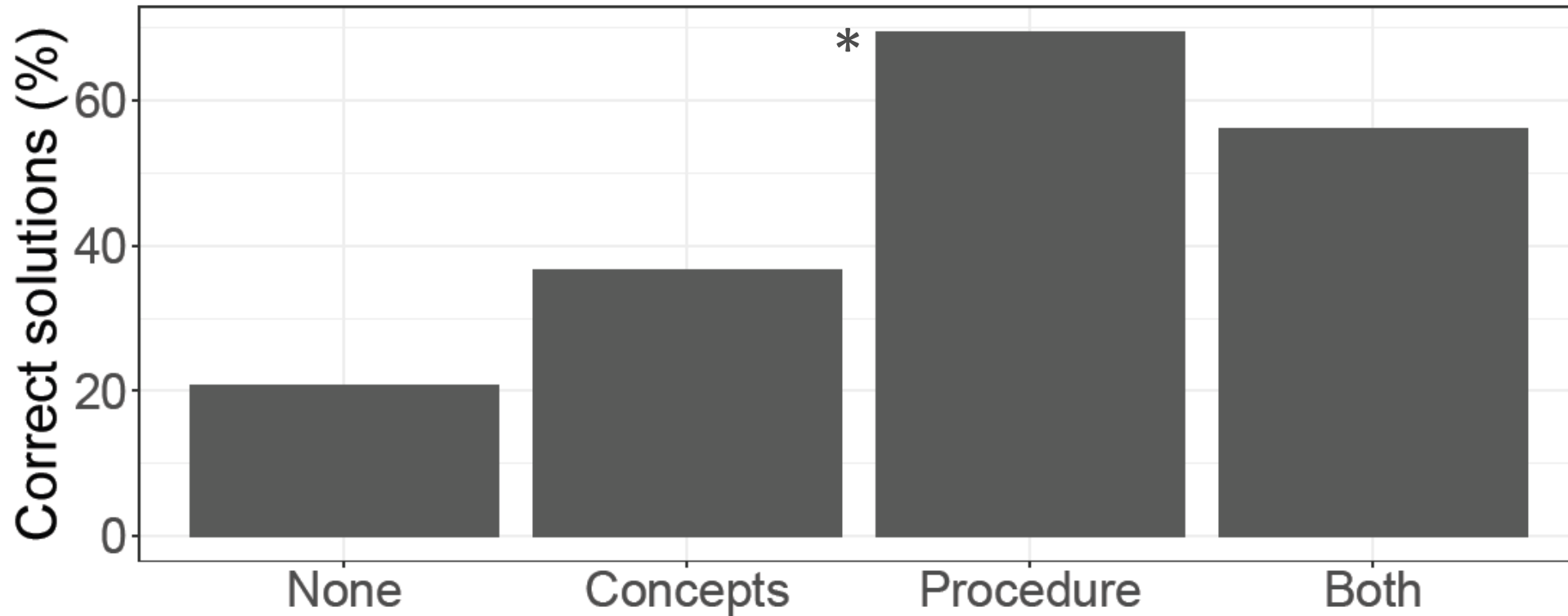


b) Move this block.

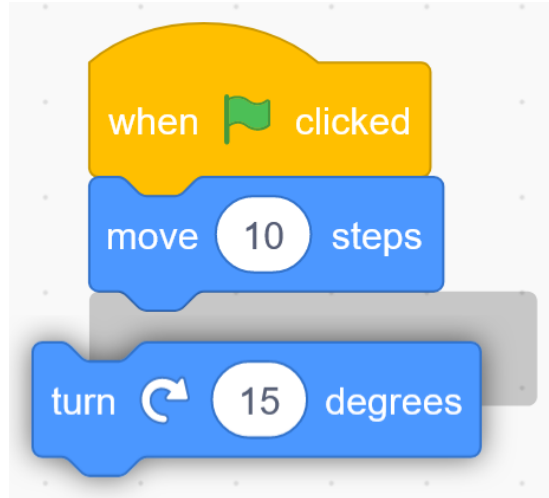
③ Test the **corrected script**:



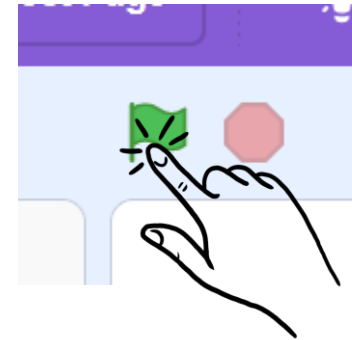
Unit 4
Debugged 6 programs
<ul style="list-style-type: none">• 2x conceptual• 2x procedural• 2x none/both
→ Performance



* significant difference



Block events



Click events

→ ScratchLog tool



Scratch Kurs   Search   

- Add Experiment
- Add Course
- Add User**
- Add Participants
- Add Participants CSV

Courses

#	Title	Description	Status
3	demo course	demo	
1	Kurs 1	Juli 2023	

Experiments


#	Title	Description	Status
9	Codeversum: Fortgeschrittenenkurs	Codeversum: Fortgeschrittenenkurs	
8	Codeversum: Anfängerkurs	Codeversum: Anfängerkurs	

Scratch Kurs     

demo course

 Edit  Delete

demo

 Status: open

Last changed: 2023-09-11T10:10:55

Stop Course

Participants

#	Username	Added
301	luisa	2023-09-11
294	gordon	2023-08-04

Edit Experiment

Title

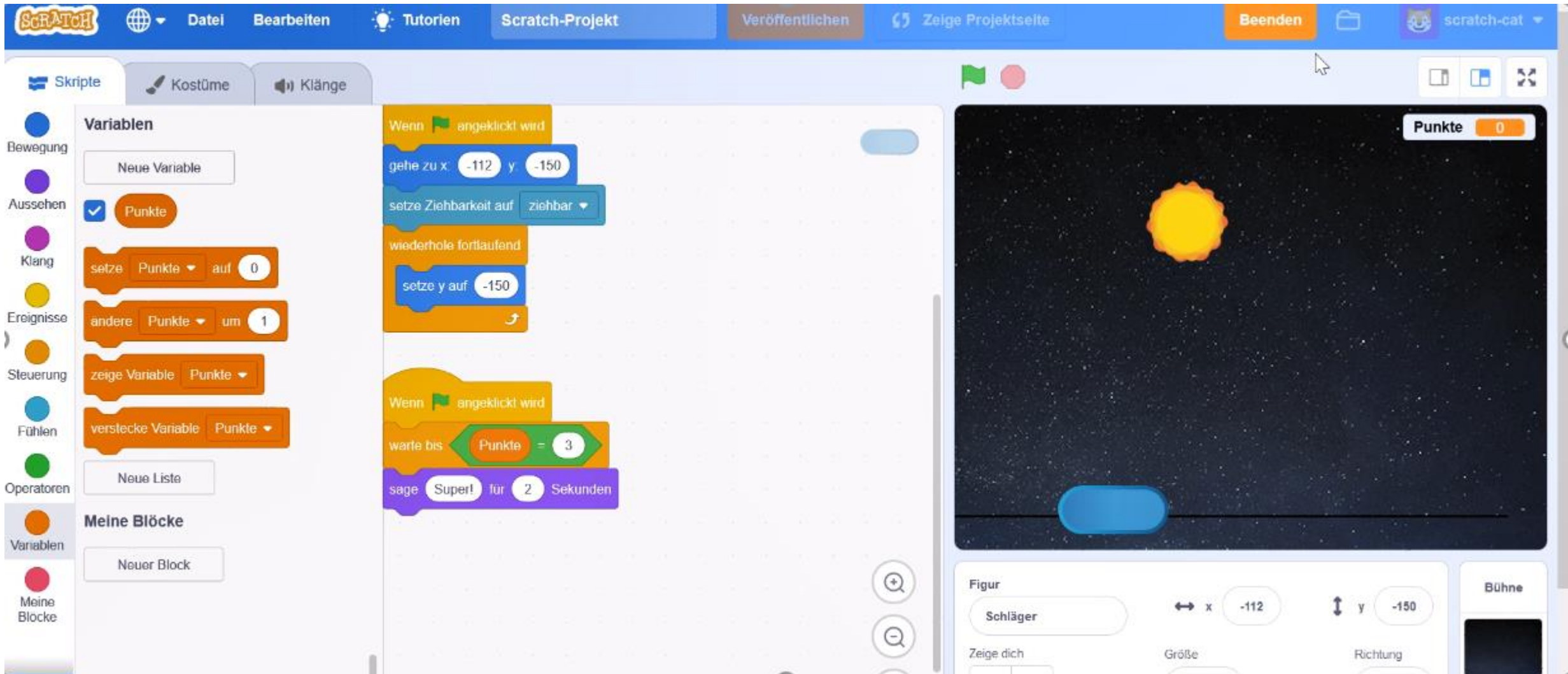
The title cannot be longer than 100 characters.

Description

The description cannot be longer than 1,000 characters.

Postscript

ScratchLog (add user data)



The screenshot shows the Scratch IDE interface. The top navigation bar includes 'Scratch', 'Datei', 'Bearbeiten', 'Tutorien', 'Scratch-Projekt', 'Veröffentlichen', 'Zeige Projektseite', 'Beenden', and a user profile 'scratch-cat'. The left sidebar shows the 'Variablen' (Variables) category selected, with a 'Punkte' variable defined. The script area contains two event-driven blocks: 'Wenn angeklickt wird' (When clicked) and 'Wenn angeklickt wird' (When clicked). The first script block includes 'gehe zu x: -112 y: -150', 'setze Ziehbarkeit auf ziehbar', and a 'wiederhole fortlaufend' loop containing 'setze y auf -150'. The second script block includes 'warte bis Punkte = 3' and 'sage Super! für 2 Sekunden'. The stage area shows a dark background with a yellow sun-like object and a blue button at the bottom. A 'Punkte' score display in the top right corner shows '0'. The bottom right panel shows the 'Figur' (Sprite) settings for 'Schläger' with x and y coordinates set to -112 and -150.

Block Events

Event	# Executed
CREATE	5
ENDDRAG	1
MOVE	5


Click Events

Event	# Executed
No entries found	

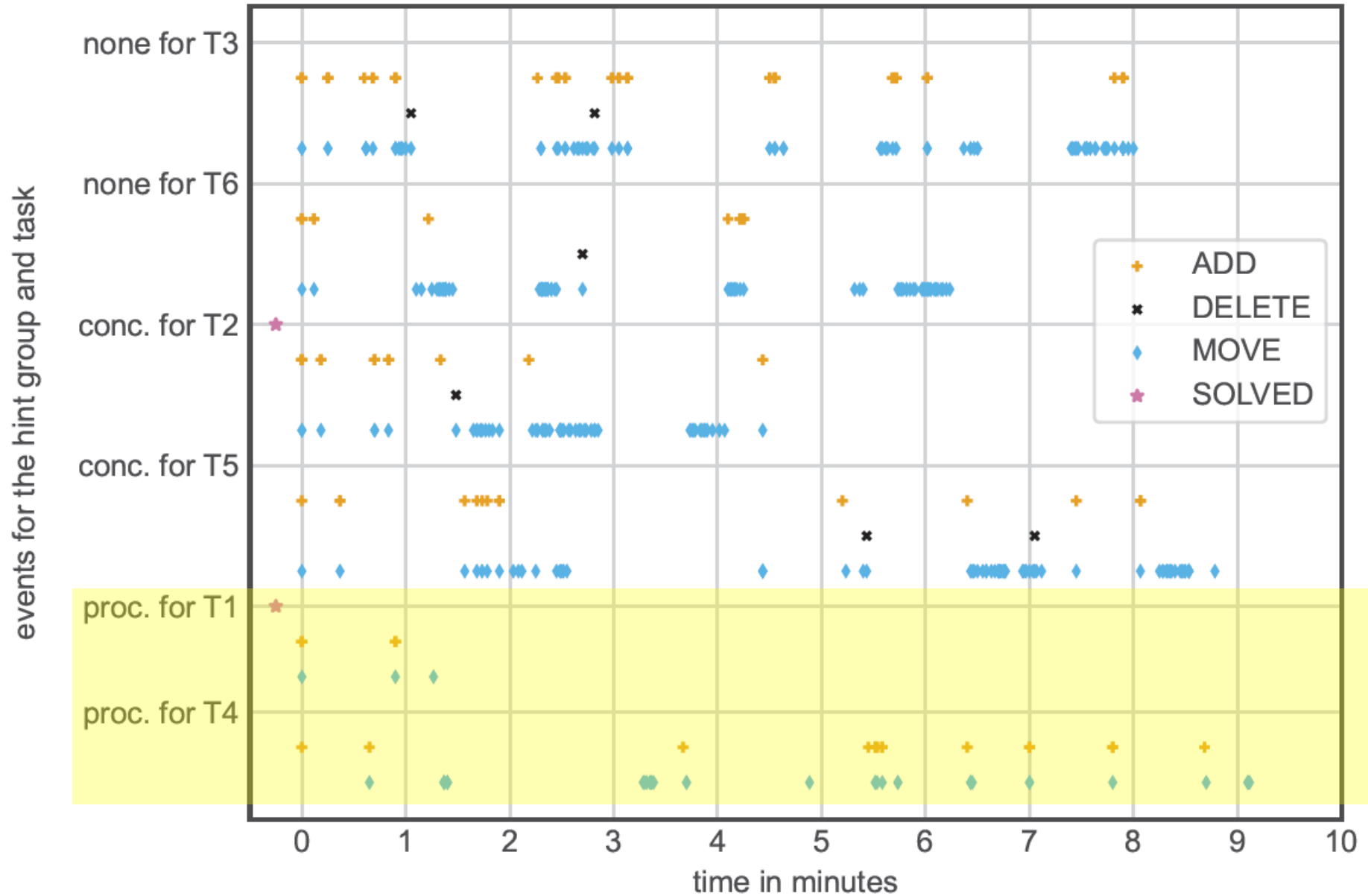
Resource Events

Event	# Executed
No entries found	

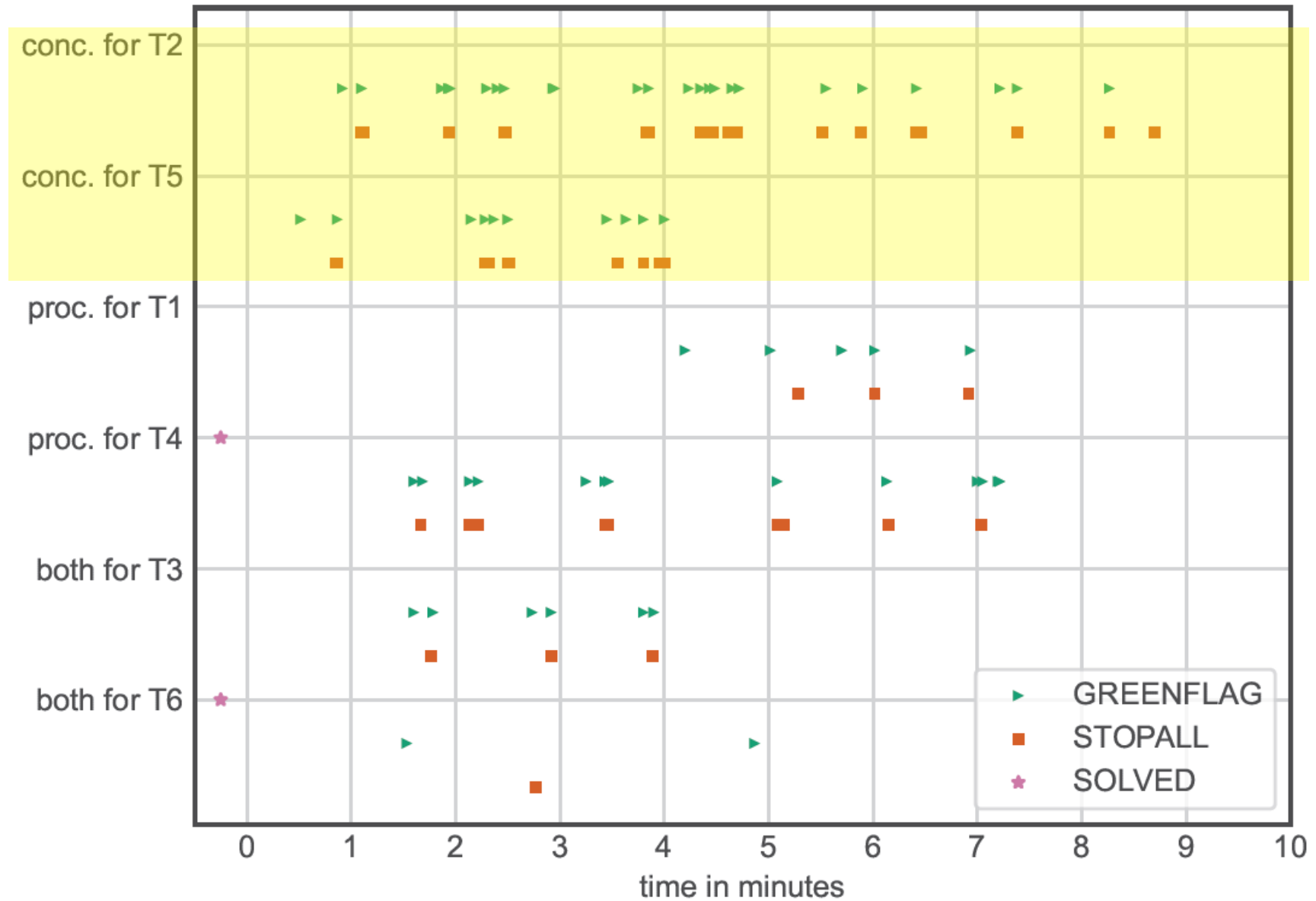
Download Sb3 Files

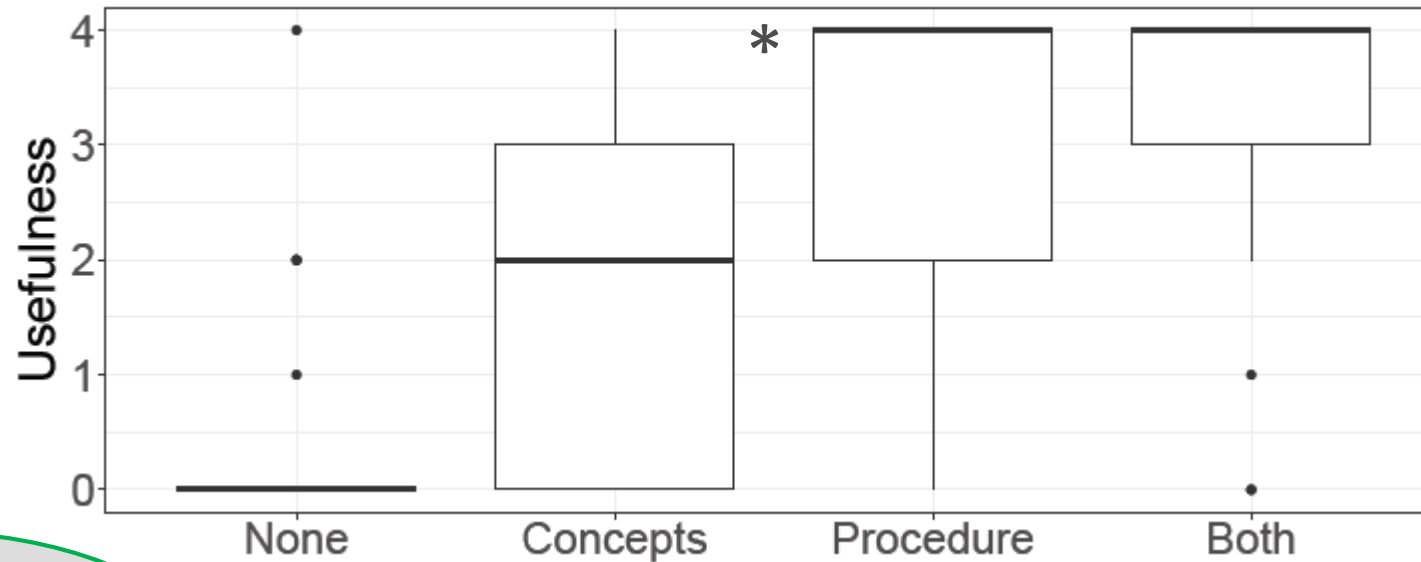
 Download All

Effects on performance (block events)



Effects on performance (click events)





* significant difference

“because I have to elaborate a bit on them” (C19)

“they cannot be envisioned easily” (C24)

“the problem is, we children are not challenged this way” (C6)

“the three step composition helped me” (C32)

Possible bug in sprite **Star: **Missing Loop****

The highlighted event in the script is only checked once. The script is ending too fast.

Enclose the event with the block **forever** to continuously check for the event.

Feedback on

- Mistakes
- Concepts
- Procedure

Task creation

Sternenjagd

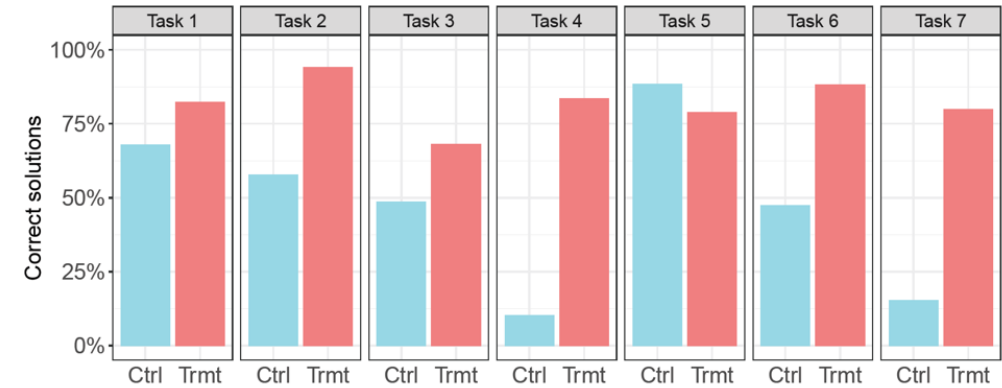
In dieser Aufgabe erweiterst du ein Programm.

- Offne Scratch.
- Klicke auf „Datei“ und „Hochladen von deinem Computer“.
- Offne den Ordner „Dateien“ und klicke auf die Datei „Sternenjagd“.
- Erweitere das Programm.
 - Andere, dass man zwei Punkte bekommt, sobald der Stern den Fisch berührt.
 - Momentan wird in der Figur „Stern“ nur 1 Punkt gegeben.
 - Das Spiel soll enden, wenn der Kugelfisch berührt wird.
 - Schau in die Figur „Qualle“. Dort funktioniert das bereits.
- Teste dein Spiel und kreuze an, was funktioniert.
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Diese Aufgabe wurde im Rahmen des Seminars „Algorithmisches Denken (Sprachprogrammierung)“ an der Universität Passau erstellt. Bildquellen: Scratch, selbst. Lösungsweg: „Anschauen und kopieren“

Group Treatment: **LITTERBOX**

Effects regarding performance



Effects on performance (click events)

