

# John Travoltage: Interactive Description

## Multimodal features for John Travoltage

- **Keyboard Navigation (alternative input)** (done)
- **Simple Description (static description)** (done)
- **Full Description (dynamic description & interaction alerts)** (done)
- **Sound** (done)
- **Voicing** (entered RC July 2021, published?)

## Related Documents

- [Voicing design document](#)
- [Fluid Wiki: PhET John Travoltage Simulation Design](#): documents the original design and prototyping work of John Travoltage by Jon Hung and Justin Obara of the Inclusive Design Research Centre at OCAD University in Toronto, Canada.

## GitHub Repository

- <https://github.com/phetsims/john-travoltage>

## Link to Published Sim

- <https://phet.colorado.edu/en/simulation/travoltage>

## Table of Contents

[Primary Learning Goals & Interactions](#)

[Heading Outline & Focus Order](#)

[State Descriptions \(all static state descriptions, some dynamic state descriptions\)](#)

[H1: John Travoltage](#)

[H2: Play Area](#)

[H2: Control Area](#)

[H2: Sim Resources](#)

[Dynamic State Descriptions](#)

[Scene/screen summary](#)

[Responsive Descriptions](#)

[Object Responses for Leg swing, slider](#)

[Table: Regions and Landmarks for Leg Swing Slider](#)

[Object Responses for Arm Swing, slider](#)

[Diagram: Regions and Landmarks for Arm Swing slider](#)

[Table: Regions and Landmarks for Arm Swing slider](#)

[Context Responses to Leg Swing and Arm Swing](#)

[Table: Charge Accumulation](#)

[Table: Discharge or Shock](#)

[Keyboard Shortcuts Dialog \(Updated July 13, 2021\)](#)

[Visual design](#)

[Accessible content for Keyboard Shortcuts](#)

[Parallel DOM diagram](#)

[Open Questions](#)

[Insights](#)

## Primary Learning Goals & Interactions

Topics: Static Electricity

Learning Goals: Describe models for common static electricity concepts such as transfer of charge, attraction, repulsion, and grounding.

Summary of Interaction:

- Rub John's foot to generate electrons on body
- Move John's hand position to explore how distance from doorknob and amount of charge affect when John gets zapped.

## Heading Outline & Focus Order

Heading Outline	Focus Order
H1: John Travoltage H2: Play Area H2: Control Area H2: Sim Resources	(Under Play Area H2 ) <ul style="list-style-type: none"> <li>• Leg Swing, slider</li> <li>• Arm Swing, slider</li> </ul> (Under Control Area H2) <ul style="list-style-type: none"> <li>• Reset All, button</li> </ul> (Under Sim Resources H2) <ul style="list-style-type: none"> <li>• Preferences</li> <li>• All Audio, toggle button</li> <li>• Keyboard Shortcuts, button</li> <li>• PhET Menu, pop up button</li> </ul>

## State Descriptions (all static state descriptions, some dynamic state descriptions)

**Note** that the descriptions in the PDOM follow the “simple” structure. Some Dynamic descriptions are mixed in with static descriptions in the first section, with more examples provided in the Dynamic Descriptions section.

### H1: John Travoltage

**Standard static intro in a paragraph** (*italicized text* is standard text used in all sims):  
 {{John Travoltage}} *is an interactive sim. It changes as you play with it.*

**Dynamic scene/screen summary and interaction hint in a single paragraph:**

John’s hand is {{close to doorknob}}, and he is ready to swing his leg to rub his foot on the rug.

- **Note:** after interaction a sentence containing the current number of charges is prepended to the scene/screen summary, “John has {{23}} charges on his body.” For more details for [Scene/Screen Summary](#) see Dynamic Descriptions section.

**Keyboard Shortcuts hint in a paragraph** (standard hint used in all sims):

*If needed, check Keyboard Shortcuts under Sim Resources.*

### H2: Play Area

**Leg Swing, slider**

Accessible name: Leg Swing

Interaction type: input type range (exposed as a “slider”)

Orientation (aria-orientation): not explicitly noted in code (naturally horizontal)

- **Note:** leg kind of swings in a semicircle.

Slider Range (-7 to 7)

- Initial position: Foot on rug (which is technically position 1)
- Two position regions, 15 qualitative positions provided in aria-valuetext as two regions, either
  - Foot on rug (-3 to 2)
  - Foot off rug (-7 to -4 and 3 to 7)
- Two landmarks (single-value regions)
  - Min position landmark: {{Foot off rug}}{{, **pointing backward
  - Max position landmark: {{Foot off rug}}{{, **pointing forward****

More details in [Responsive Descriptions](#) section

**Arm Swing, slider**

Accessible Name: Arm Swing

Interaction type: input type range (exposed as a “slider”)

Orientation (aria-orientation): not explicitly noted in code

- Has exact same implementation as the Leg Swing
- From the starting position Up Arrow (and Right Arrow) move hand up away from doorknob or counter-clockwise, and Down Arrow (and Left Arrow key) move hand towards doorknob or clockwise.
- Best Arrow key combination is shown and described in Keyboard Shortcuts
- **Note:** Visually the arm moves in a circle.

Slider Range (-15 to 15) with position 0 marking the doorknob.

- Initial position: Hand pointing at upper door, close to doorknob. (-4)
- 12 position region descriptions, 2 examples:
  - {{Close to doorknob}}. (-3 to -5:)
  - {{Not so close to doorknob.}} (-6 to -8: )
- Nine **Landmark** descriptions, 2 examples:
  - {{**Hand pointing at upper door**}} {{, close to doorknob}}. (-4)
  - {{**Hand pointing straight up**}} {{, not so close to doorknob}}. (-8)
- Progress indicators removed

More details for [Object Responses for Arm Swing](#) in Dynamic Descriptions section

## H2: Control Area

### Reset All

Accessible Name: *Reset All*

Interaction type: button (or reset button)

Standard user interface alert:

- *Sim screen restarted. Everything reset.*

## H2: Sim Resources

### Preferences

Accessible Name: Preferences

Interaction type: button

No context responses, the dialog opens and starts reading the H1 in the dialog

### All Audio

Accessible Name: All Audio

Interaction type: toggle button

Standard alerts:

- *Audio features on.*
- *Audio features off.*
- **Note:** *connected to the Audio Features on/off button in the Preferences dialog.*

**Keyboard Shortcuts**

Accessible Name: Keyboard Shortcuts

Interaction type: button

No context responses, the dialog opens and starts reading the H1 in the dialog

**PhET Menu, button**

Accessible Name: see above

Interaction type: button, pop-up

No context responses, the dialog opens and starts the menu items

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## Dynamic State Descriptions

### Scene/screen summary

**Intro paragraph after interaction:**

{{John has {{8}} charges on his body.}} John's hand is {{close to doorknob}}, and he is ready to swing his leg to rub his foot on the rug.

**Intro paragraph after complete discharge:**

John has {{0}} charges on his body. John's hand is {{at doorknob}}, and he is ready to swing his leg to rub his foot on the rug.

**After a reset** (and after sim loads for the first time):

John's hand is {{close to doorknob}}, and he is ready to swing his leg to rub his foot on the rug.

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## Responsive Descriptions

### Object Responses for Leg swing, slider

The qualitative *Leg Swing* position descriptions are provided through *aria-valuetext* (no position numbers are provided). Using *aria-valuetext* the user automatically gets new information on keyboard focus and during positional changes.

The important information to know about the foot is that it is either “on rug” or “off rug”. The *Leg Swing* slider has 15 positions ranging from -7 to 7. Passing through Position -3 through to Position 2 causes electrons (charges) to transfer from the rug to John's body. With the initial position starting at position 1, movement in either direction results in a transfer of charge.

There are two simple landmarks that are appended to the extreme positions for the *Leg Swing* slider to provide additional orientation:

- “pointing backward” at position -7,
- “pointing forward” at position 7.

Table: Regions and Landmarks for Leg Swing Slider

In an earlier published version, we used “Foot rubbing on rug.” Sonification provides a rubbing sound, so during the Voicing design, we decided to remove “rubbing” from the string.

Position Number	Region Description	Landmark Description	Design Notes
-7	Foot off rug	, <b>pointing backward.</b>	Simple landmark added for orientation
-6	Foot off rug		
-5	Foot off rug		
-4	Foot off rug		
-3	Foot on rug		
-2	Foot on rug		
-1	Foot on rug		
0	Foot on rug		
1	Foot on rug		Starting position on page load.  Movement forward or backward should result in a transfer of charge.
2	Foot on rug		
3	Foot off rug		
4	Foot off rug		
5	Foot off rug		
6	Foot off rug		

7	Foot off rug	, <b>pointing forward.</b>	Simple landmark added for orientation
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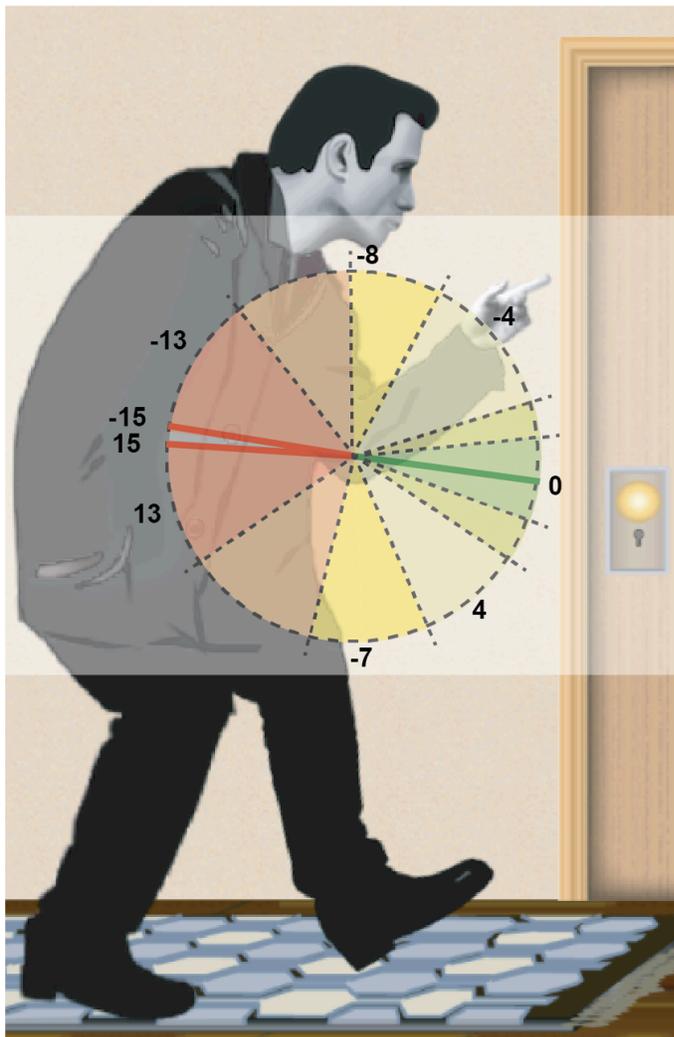
## Object Responses for Arm Swing, slider

The qualitative *Arm Swing* position descriptions are provided through *aria-valuetext* (no position numbers are provided). Using *aria-valuetext* the user automatically gets new information on keyboard focus and during positional changes. Far more details were needed to provide an engaging and pedagogically useful described experience for the arm/hand. We ended up with 12 unique positions (or landmarks) to describe 31 positions which visually follow a 360 degree circle.

- Dimension of scale: Describes the approximate distance that John's hand is from the doorknob.
- Range: 8-point distance scale, spread across 15 regions, 7 above the doorknob and 7 below the doorknob.
- 8-point distance scale:
  - Farthest from
  - Very far from
  - Far from
  - Not so close to
  - Close to
  - Very close to
  - Just above
  - At doorknob

## Diagram: Regions and Landmarks for Arm Swing slider

In figure below, (left panel): A pie chart overlays John's arm showing the circular range of the arm and the relative size (range) of region descriptions. Regions closer to doorknob have a smaller range. Numbers around the outside of the pie chart mark the single-value landmark region positions or landmarks. These 9 landmarks are key orientation points. (right panel) A table next to the diagram lists out all of the region descriptions and landmarks (bold text) and the associated position values with which they are associated.



Position #	Landmark & Region Descriptions [RD]
-15	<b>Farthest from doorknob. Last stop.</b>
-14	Very far from doorknob.
-13	<b>Hand pointing away from door, [RD].</b>
-12	Very far from doorknob.
-11 to -9	Far from doorknob.
-8	<b>Hand pointing straight up.</b>
-7	Not so close to doorknob.
-6	Not so close to doorknob.
-5	Close to doorknob.
-4	<b>Hand pointing at upper door, [RD].</b>
-3	Close to doorknob.
-2	Very close to doorknob.
-1	Just above doorknob.
0	<b>At doorknob.</b>
1	Just below doorknob.
2	Very close to doorknob.
3	Close to doorknob.
4	<b>Hand pointing at lower door, [RD].</b>
5	Close to doorknob.
6	Not so close to doorknob.
7	<b>Hand pointing straight down.</b>
8	Not so close to doorknob.
9 to 11	Far from doorknob.
12	Very far from doorknob.
13	<b>Hand pointing away from door, [RD].</b>
14	Very far from doorknob.
15	<b>Farthest from doorknob. Last stop.</b>

Table: Regions and Landmarks for Arm Swing slider

Table below lists out landmarks (bolded text) and region descriptions for each position of the Arm Position Slider (also represented in right panel of figure above). **Note:** not included are the dynamic progress phrases, “Towards doorknob” and “Away from doorknob” which are no longer part of the interaction. These phrases were part of the original release of this sim.

Position Number (no longer part of aria-valuetext)	Landmarks and Region Descriptions
-15	<b>Hand farthest from doorknob</b>
-14	Hand very far from doorknob

-13	<b>Hand pointing away from door</b> , very far from doorknob
-12	Hand very far from doorknob
-11	Hand far from doorknob
-10	Hand far from doorknob
-9	Hand far from doorknob
-8	<b>Hand pointing straight up</b>
-7	Hand not so close to doorknob
-6	Hand not so close to doorknob
-5	Hand close to doorknob
-4	<b>Hand pointing at upper door</b> , close to doorknob.
-3	Hand close to doorknob
-2	Hand very close to doorknob
-1	Hand just above doorknob
0	<b>Hand at doorknob</b>
1	Hand just below doorknob
2	Hand very close to doorknob
3	Hand close to doorknob
4	<b>Hand pointing at lower door</b> , close to doorknob
5	Hand close to doorknob
6	Hand not so close to doorknob
7	<b>Hand pointing straight down</b>
8	Hand not so close to doorknob
9	Hand far from doorknob
10	Hand far from doorknob
11	Hand far from doorknob
12	Hand very far from doorknob

13	<b>Hand pointing away from door</b> , very far from doorknob
14	Hand very far from doorknob
15	<b>Hand farthest from doorknob</b>

**Note:** Several minor changes were made to object responses when we iterated on the description design to create the Voicing design. Here's a list of changes that made it into the Interactive Description design:

- Changed slider name from “Hand” Position to “Arm Swing”.
- Removed “Position” and all position numbers from object responses, replacing that with “Hand”, so all Arm Swing positions start with “Hand.”
- “Last stop.” was removed from the “Farthest from doorknob” landmark position. Periods were also removed from object responses in the aria-valuetext.

## Context Responses to Leg Swing and Arm Swing

There are two context responses in John Travoltage, the charge accumulation response and the discharge response. Note that the standard context response is also triggered when the *Reset All button* is pressed.

Table: Charge Accumulation

Interactive Object	Context response for successful charge transfer	Notes on interaction
Leg Swing, slider	Electrons on body: {{5}} Electrons on body: {{10}} Electrons on body: {{35}}  etc.	Max number of charges is 100.

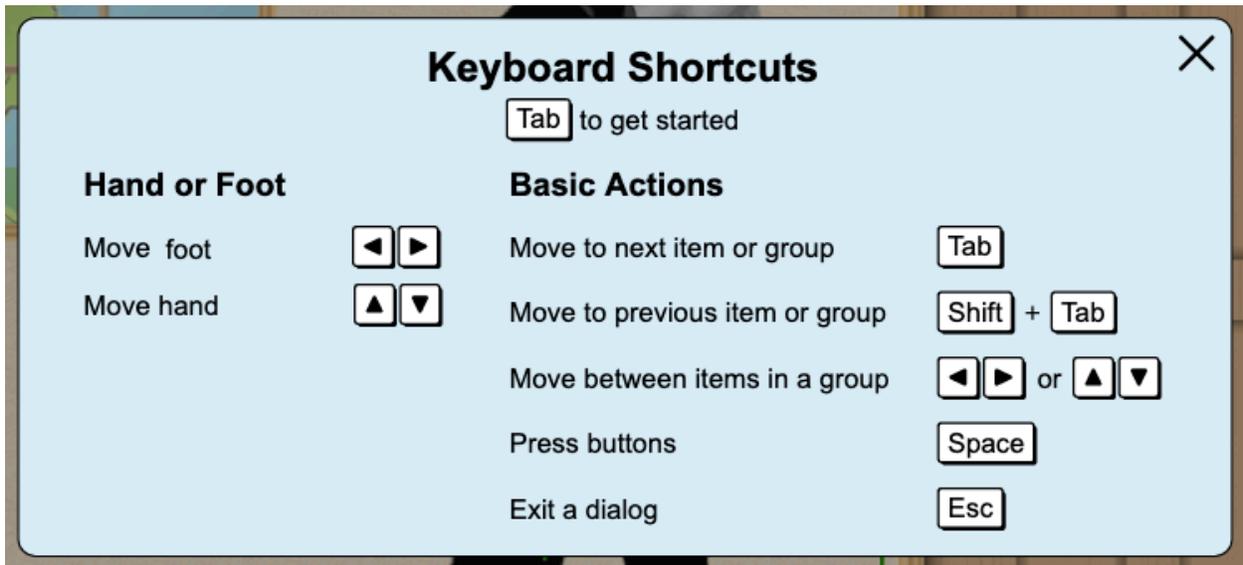
Table: Discharge or Shock

Interactive Object	Alert for discharge	Notes on interaction
Leg Swing, slider Arm Swing, slider	Discharge occurred. Electrons on body decreased from {{35}} to {{0}} with hand {{very close to doorknob}}.	A minimum of 10 charges is needed to create a discharge.

# Keyboard Shortcuts Dialog

## Visual design

Latest version 1.6.0 (2021-08-19)



## Accessible content for Keyboard Shortcuts

H1: Keyboard Shortcuts

P: Tab to get started

H2: Hand or Foot

UL:

LI: Move foot with Left and Right Arrow keys.

LI: Move hand with Up and Down Arrow keys.

H2: Basic Actions

UL

LI: Move to next item or group with Tab key.

LI: Move to previous item or group with Shift plus Tab key.

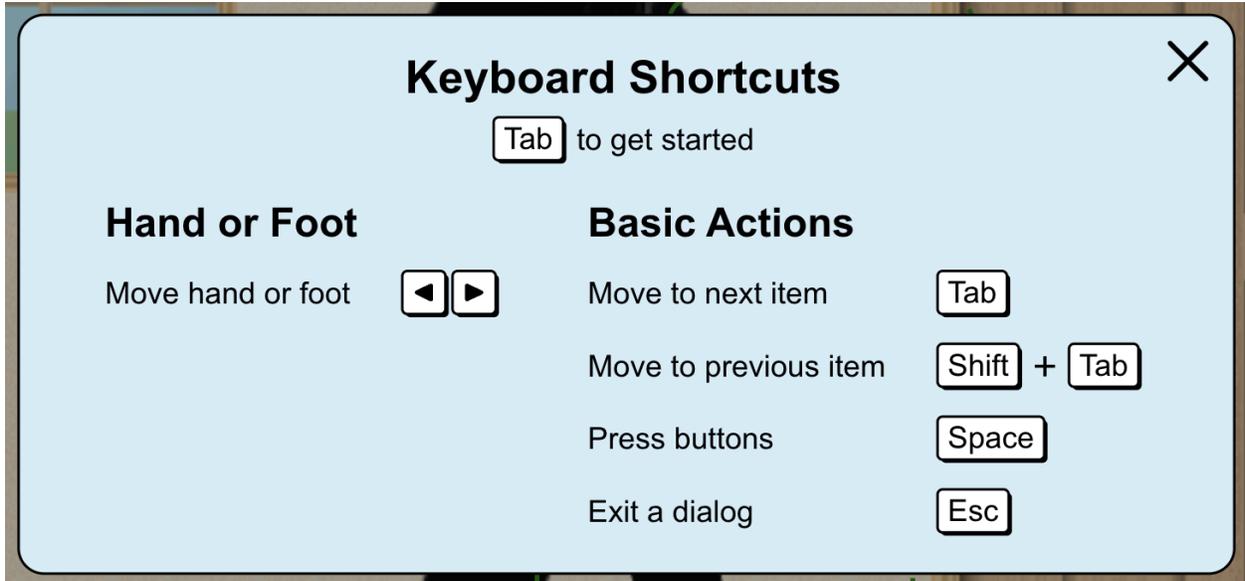
LI: Move between items in a group with Left and Right arrow keys or Up and Down arrow keys.

LI: Press buttons with Space key.

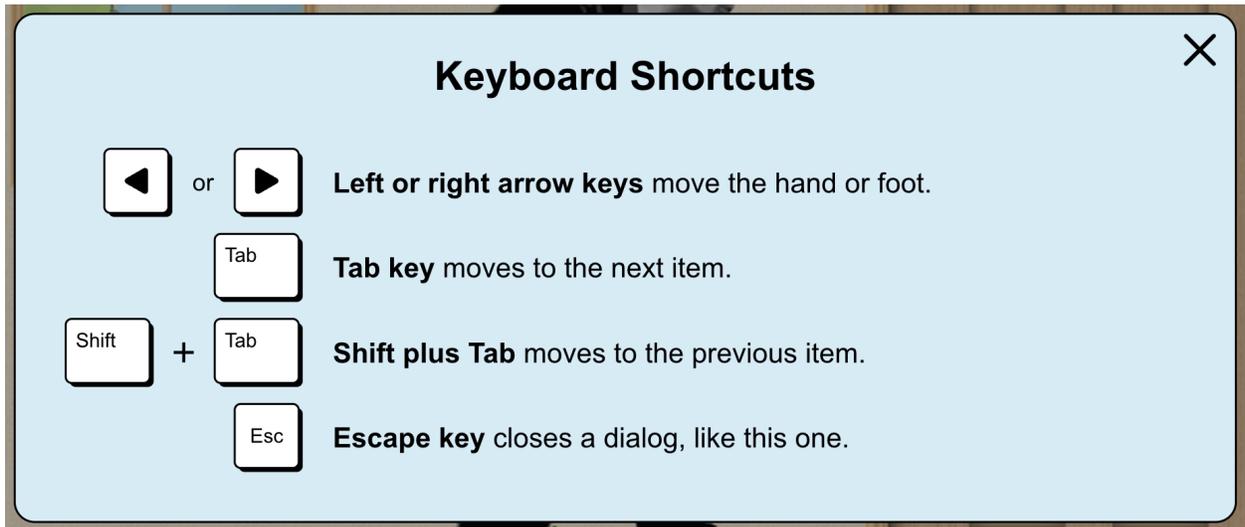
LI: Exit a dialog with Escape key.

## Previous Iterations of the Keyboard Shortcuts Dialog

Version 1.5.0 (2018-10-10)



Version 1.3.0 (2017-05-12)

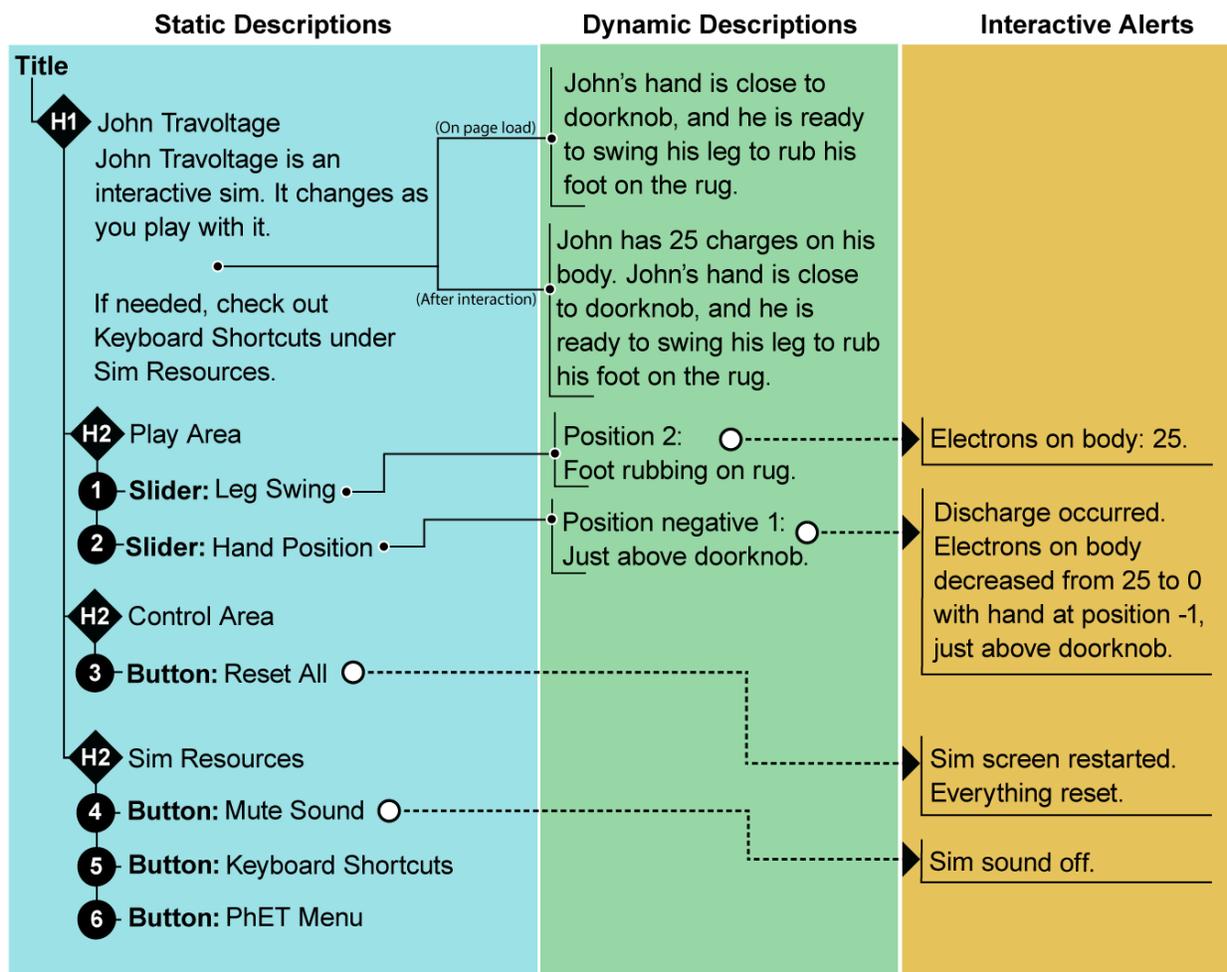


## Parallel DOM diagram

Diagram showing how John Travoltage’s Static State Descriptions, Dynamic State Descriptions and Responsive Descriptions (formerly referred to as Interactive Alerts) work together to create an engaging described experience for non-visual users. **Note:** The descriptions are all from the

original interactive description design somewhat different from above. Preferences button is not included in this diagram as, and the Mute Sound toggle button is now the All Audio toggle button.

## Parallel DOM



## Open Questions

Questions and insights to consider in future iterations with John Travoltage.

**Description Display:** Current description uses the word “discharge” and does not include the word “shock”. From interviews, it seems like description users are verbalizing the word “discharge” as they talk about the sim, and not using “shock” - which is common for visual display users. We could consider refining the discharge alert to read out something like “John shocked. X electrons discharged.”

- **Note:** in Voicing design we added new hints, some of which include the word, “shock.” Not all changes made for Voicing have made it into the Interactive Description. In Voicing the general hint available through the hint button is dynamic:
  - Without charges on body: Swing John’s leg to rub his foot on rug.
  - With charges on body: Move John’s hand to see when he gets a shock.

In addition, if hints is enabled in preferences, when interacting with the Arm or Leg Swing sliders, a learner might hear, “Move John’s hand” or “Move John’s foot” when they are first getting started.

**Visual Display:** There may be a need for an additional visual ‘hint’ to support learners who repeatedly ‘click’ on arm or leg rather than ‘click and drag’. A likely approach would be the addition of green visual arrows indicating a ‘back and forth’ motion that disappears after first successful interaction (similar to visual cues used in the simulation Molecule Polarity).

- **Note:** the additional Voicing hints may help some learners through this problem.

**Supporting Materials:** From interviews we have found some students, during open play, can put the arm in the position nearest the doorknob, and then focus most of their time/attention on rubbing the foot (in particular, see data collected from students with intellectual and developmental disabilities). The result is a near continuous discharge event, without exploration of how the location of the arm impacts discharge. We might consider in the future how to support teachers in predicting when this might be a particularly distracting scenario for students, and prompts that can support productive use of this scenario and prompts to gently encourage other scenarios to explore.

## Insights

Insights from design will be considered in future iterations with John Travoltage and other simulations.

**Description Display:** This simulation was one of the first for which we designed interactive description. Among other things, we learned that keeping things in the active present - now! - whenever possible is important.

In the first release(2017-05-12), the summary description is always in the present tense describing the current state, and “Foot rubbing on rug” originally described rubbing in the present progressive. The hand position descriptions and the charge accumulation did not include the verb to be, “is”, thus these descriptions have no grammatical tense, but feel like they are in the present. The exception is the discharge response which describes a past event, thus is described in the past tense, for example, "Discharge occurred. Electrons on body decreased from 25 to 0 with hand just above doorknob." It works fine to describe an event like this - an event that logs something that happens quickly - in the past tense.