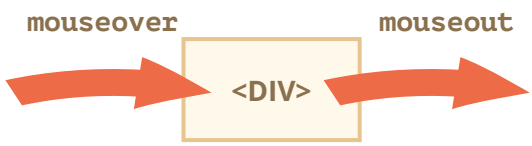
19th December 2019

# Moving the mouse: mouseover/out, mouseenter/leave

Let's dive into more details about events that happen when the mouse moves between elements.

## Events mouseover/mouseout, relatedTarget

The `mouseover` event occurs when a mouse pointer comes over an element, and `mouseout` – when it leaves.




These events are special, because they have property `relatedTarget`. This property complements `target`. When a mouse leaves one element for another, one of them becomes `target`, and the other one – `relatedTarget`.

For `mouseover`:

- `event.target` – is the element where the mouse came over.
- `event.relatedTarget` – is the element from which the mouse came (`relatedTarget` → `target`).

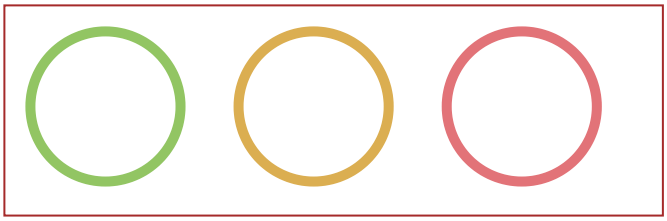
For `mouseout` the reverse:

- `event.target` – is the element that the mouse left.
- `event.relatedTarget` – is the new under-the-pointer element, that mouse left for (`target` → `relatedTarget`).

In the example below each face and its features are separate elements. When you move the mouse, you can see mouse events in the text area.

Each event has the information about both `target` and `relatedTarget`:

Result script.js style.css index.html



Events will show up here!

### `relatedTarget` can be `null`

The `relatedTarget` property can be `null`.

That's normal and just means that the mouse came not from another element, but from out of the window. Or that it left the window.

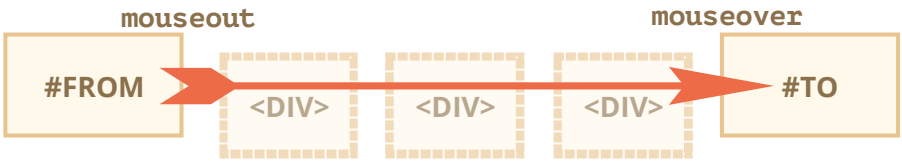
We should keep that possibility in mind when using `event.relatedTarget` in our code. If we access `event.relatedTarget.tagName`, then there will be an error.

## Skipping elements

The `mousemove` event triggers when the mouse moves. But that doesn't mean that every pixel leads to an event.

The browser checks the mouse position from time to time. And if it notices changes then triggers the events.

That means that if the visitor is moving the mouse very fast then some DOM-elements may be skipped:

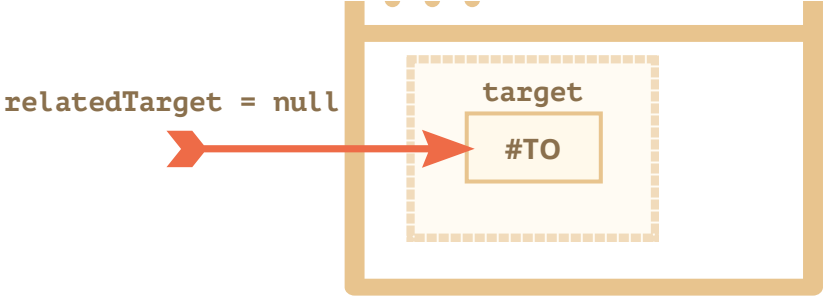



If the mouse moves very fast from `#FROM` to `#TO` elements as painted above, then intermediate `<div>` elements (or some of them) may be skipped. The `mouseout` event may trigger on `#FROM` and then immediately `mouseover` on `#TO`.

That's good for performance, because there may be many intermediate elements. We don't really want to process in and out of each one.

On the other hand, we should keep in mind that the mouse pointer doesn't "visit" all elements along the way. It can "jump".

In particular, it's possible that the pointer jumps right inside the middle of the page from out of the window. In that case `relatedTarget` is `null`, because it came from "nowhere":




You can check it out “live” on a teststand below.

Its HTML has two nested elements: the `<div id="child">` is inside the `<div id="parent">`. If you move the mouse fast over them, then maybe only the child div triggers events, or maybe the parent one, or maybe there will be no events at all.

Also move the pointer into the child `div`, and then move it out quickly down through the parent one. If the movement is fast enough, then the parent element is ignored. The mouse will cross the parent element without noticing it.

Result script.js style.css index.html

parent

child

Clear

### If `mouseover` triggered, there must be `mouseout`

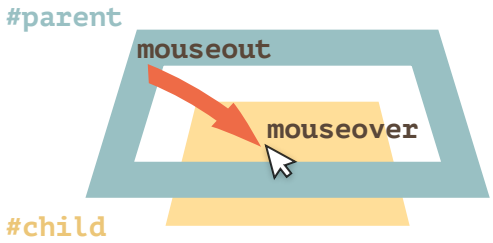
In case of fast mouse movements, intermediate elements may be ignored, but one thing we know for sure: if the pointer “officially” entered an element (`mouseover` event generated), then upon leaving it we always get `mouseout`.

## Mouseout when leaving for a child

An important feature of `mouseout` – it triggers, when the pointer moves from an element to its descendant, e.g. from `#parent` to `#child` in this HTML:

```
<div id="parent">
  <div id="child">...</div>
</div>
```

If we're on `#parent` and then move the pointer deeper into `#child`, but we get `mouseout` on `#parent`!



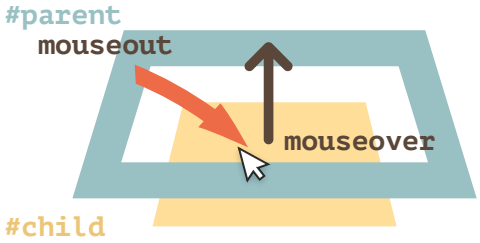

That may seem strange, but can be easily explained.

**According to the browser logic, the mouse cursor may be only over a *single* element at any time – the most nested one and top by z-index.**

So if it goes to another element (even a descendant), then it leaves the previous one.

Please note another important detail of event processing.

The `mouseover` event on a descendant bubbles up. So, if `#parent` has `mouseover` handler, it triggers:




You can see that very well in the example below: `<div id="child">` is inside the `<div id="parent">`. There are `mouseover/out` handlers on `#parent` element that output event details.

If you move the mouse from `#parent` to `#child`, you see two events on `#parent`:

1. `mouseout [target: parent]` (left the parent), then
2. `mouseover [target: child]` (came to the child, bubbled).

Result script.js style.css index.html

parent

child

Clear

As shown, when the pointer moves from `#parent` element to `#child`, two handlers trigger on the parent element: `mouseout` and `mouseover`:

```
parent.onmouseout = function(event) {
  /* event.target: parent element */
};
parent.onmouseover = function(event) {
  /* event.target: child element (bubbled) */
};
```

**If we don't examine `event.target` inside the handlers, then it may seem that the mouse pointer left `#parent` element, and then immediately came back over it.**

But that's not the case! The pointer is still over the parent, it just moved deeper into the child element.

If there are some actions upon leaving the parent element, e.g. an animation runs in `parent.onmouseout`, we usually don't want it when the pointer just goes deeper into `#parent`.

To avoid it, we can check `relatedTarget` in the handler and, if the mouse is still inside the element, then ignore such event.

Alternatively we can use other events: `mouseenter` and `mouseleave`, that we'll be covering now, as they don't have such problems.

# Events mouseenter and mouseleave

Events `mouseenter/mouseleave` are like `mouseover/mouseout`. They trigger when the mouse pointer enters/leaves the element.

But there are two important differences:

1. Transitions inside the element, to/from descendants, are not counted.
2. Events `mouseenter/mouseleave` do not bubble.

These events are extremely simple.

When the pointer enters an element – `mouseenter` triggers. The exact location of the pointer inside the element or its descendants doesn't matter.

When the pointer leaves an element – `mouseleave` triggers.

This example is similar to the one above, but now the top element has `mouseenter/mouseleave` instead of `mouseover/mouseout`.

As you can see, the only generated events are the ones related to moving the pointer in and out of the top element. Nothing happens when the pointer goes to the child and back. Transitions between descendants are ignored

Result script.js style.css index.html

parent

child

Clear

# Event delegation

Events `mouseenter/leave` are very simple and easy to use. But they do not bubble. So we can't use event delegation with them.

Imagine we want to handle mouse enter/leave for table cells. And there are hundreds of cells.

The natural solution would be – to set the handler on `<table>` and process events there. But `mouseenter/leave` don't bubble. So if such event happens on `<td>`, then only a handler on that `<td>` is able to catch it.

Handlers for `mouseenter/leave` on `<table>` only trigger when the pointer enters/leaves the table as a whole. It's impossible to get any information about transitions inside it.

So, let's use `mouseover/mouseout`.

Let's start with simple handlers that highlight the element under mouse:

```
1  // let's highlight an element under the pointer
2  table.onmouseover = function(event) {
```

```
  let target = event.target;
  target.style.background = 'pink';
};

table.onmouseout = function(event) {
  let target = event.target;
  target.style.background = '';
};
```

Here they are in action. As the mouse travels across the elements of this table, the current one is highlighted:

Result script.js style.css index.html

***Bagua* Chart: Direction, Element, Color, Meaning**

| | | |
|---|---|---|
| **Northwest** | **North** | **Northeast** |
| Metal | Water | Earth |
| Silver | Blue | Yellow |
| Elders | Change | Direction |
| **West** | **Center** | **East** |
| Metal | All | Wood |
| Gold | Purple | Blue |
| Youth | Harmony | Future |
| **Southwest** | **South** | **Southeast** |
| Earth | Fire | Wood |
| Brown | Orange | Green |
| Tranquility | Fame | Romance |

Clear

In our case we'd like to handle transitions between table cells `<td>` : entering a cell and leaving it. Other transitions, such as inside the cell or outside of any cells, don't interest us. Let's filter them out.

Here's what we can do:

- Remember the currently highlighted `<td>` in a variable, let's call it `currentElem` .
- On `mouseover` – ignore the event if we're still inside the current `<td>` .
- On `mouseout` – ignore if we didn't leave the current `<td>` .

Here's an example of code that accounts for all possible situations:

```
// <td> under the mouse right now (if any)
let currentElem = null;
```

```
table.onmouseover = function(event) {
  // before entering a new element, the mouse always leaves the previous one
  // if currentElem is set, we didn't leave the previous <td>,
  // that's a mouseover inside it, ignore the event
  if (currentElem) return;

  let target = event.target.closest('td');

  // we moved not into a <td> - ignore
  if (!target) return;

  // moved into <td>, but outside of our table (possible in case of nested ta
  // ignore
  if (!table.contains(target)) return;

  // hooray! we entered a new <td>
  currentElem = target;
  onEnter(currentElem);
};


table.onmouseout = function(event) {
  // if we're outside of any <td> now, then ignore the event
  // that's probably a move inside the table, but out of <td>,
  // e.g. from <tr> to another <tr>
  if (!currentElem) return;

  // we're leaving the element — where to? Maybe to a descendant?
  let relatedTarget = event.relatedTarget;

  while (relatedTarget) {
    // go up the parent chain and check — if we're still inside currentElem
    // then that's an internal transition — ignore it
    if (relatedTarget == currentElem) return;

    relatedTarget = relatedTarget.parentNode;
  }

  // we left the <td>. really.
  onLeave(currentElem);
  currentElem = null;
};

// any functions to handle entering/leaving an element
function onEnter(elem) {
  elem.style.background = 'pink';

  // show that in textarea
  text.value += `over -> ${currentElem.tagName}.${currentElem.className}\n`;
  text.scrollTop = 1e6;
}

function onLeave(elem) {
  elem.style.background = '';

  // show that in textarea
  text.value += `out <- ${elem.tagName}.${elem.className}\n`;
  text.scrollTop = 1e6;
}
```

Once again, the important features are:

1. It uses event delegation to handle entering/leaving of any `<td>` inside the table. So it relies on `mouseover/out` instead of `mouseenter/leave` that don't bubble and hence allow no delegation.
2. Extra events, such as moving between descendants of `<td>` are filtered out, so that `onEnter/Leave` runs only if the pointer leaves or enters `<td>` as a whole.

Here's the full example with all details:

Result script.js style.css index.html

***Bagua* Chart: Direction, Element, Color, Meaning**

| | | |
|---|---|---|
| **Northwest** | **North** | **Northeast** |
| Metal | Water | Earth |
| Silver | Blue | Yellow |
| Elders | Change | Direction |
| **West** | **Center** | **East** |
| Metal | All | Wood |
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| Youth | Harmony | Future |
| **Southwest** | **South** | **Southeast** |
| Earth | Fire | Wood |
| Brown | Orange | Green |
| Tranquility | Fame | Romance |

Clear

Try to move the cursor in and out of table cells and inside them. Fast or slow – doesn't matter. Only `<td>` as a whole is highlighted, unlike the example before.

# Summary

We covered events `mouseover`, `mouseout`, `mousemove`, `mouseenter` and `mouseleave`.

These things are good to note:

- A fast mouse move may skip intermediate elements.
- Events `mouseover/out` and `mouseenter/leave` have an additional property: `relatedTarget`. That's the element that we are coming from/to, complementary to `target`.

Events `mouseover/out` trigger even when we go from the parent element to a child element. The browser assumes that the mouse can be only over one element at one time – the deepest one.

Events `mouseenter/leave` are different in that aspect: they only trigger when the mouse comes in and out the element as a whole. Also they do not bubble.

# Tasks

## Improved tooltip behavior

importance: 5

Write JavaScript that shows a tooltip over an element with the attribute `data-tooltip`. The value of this attribute should become the tooltip text.

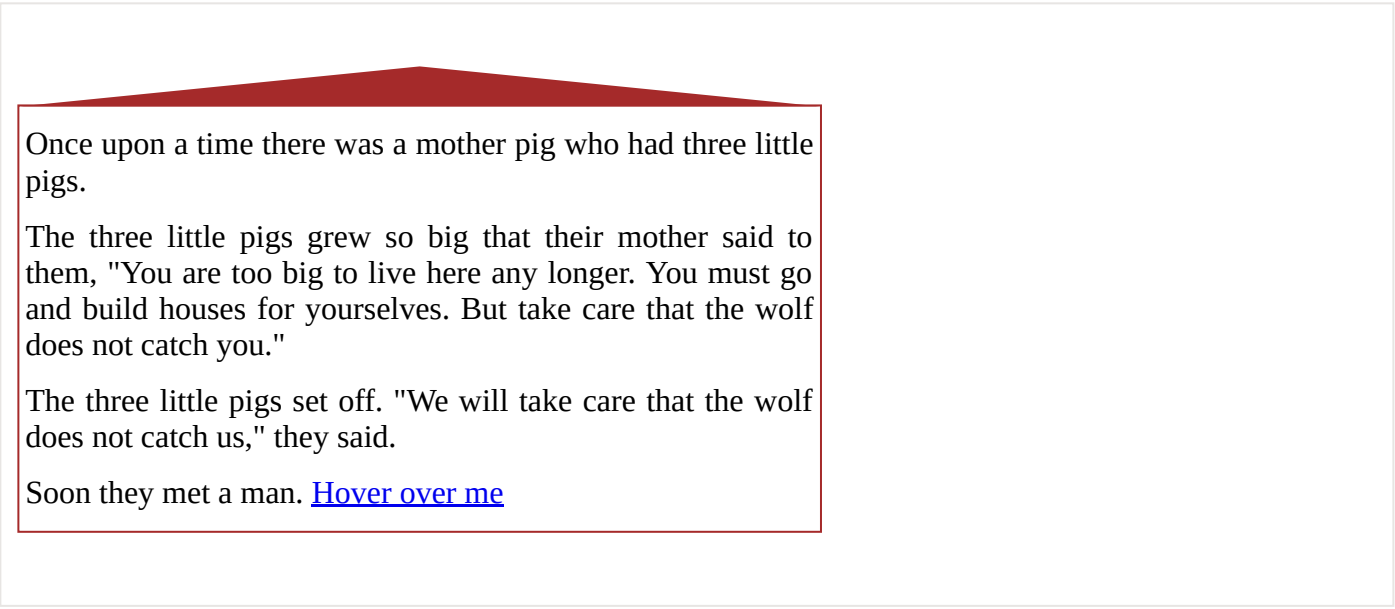
That's like the task Tooltip behavior, but here the annotated elements can be nested. The most deeply nested tooltip is shown.

Only one tooltip may show up at the same time.

For instance:

```
<div data-tooltip="Here – is the house interior" id="house">
  <div data-tooltip="Here – is the roof" id="roof"></div>
  ...
  <a href="https://en.wikipedia.org/wiki/The_Three_Little_Pigs" data-tooltip=
</div>
```

The result in iframe:




Open a sandbox for the task.

solution

## "Smart" tooltip

importance: 5

Write a function that shows a tooltip over an element only if the visitor moves the mouse *to it*, but not *through it*.

In other words, if the visitor moves the mouse to the element and stops there – show the tooltip. And if they just moved the mouse through, then no need, who wants extra blinking?

Technically, we can measure the mouse speed over the element, and if it's slow then we assume that it comes "over the element" and show the tooltip, if it's fast – then we ignore it.

Make a universal object `new HoverIntent(options)` for it.

Its `options` :

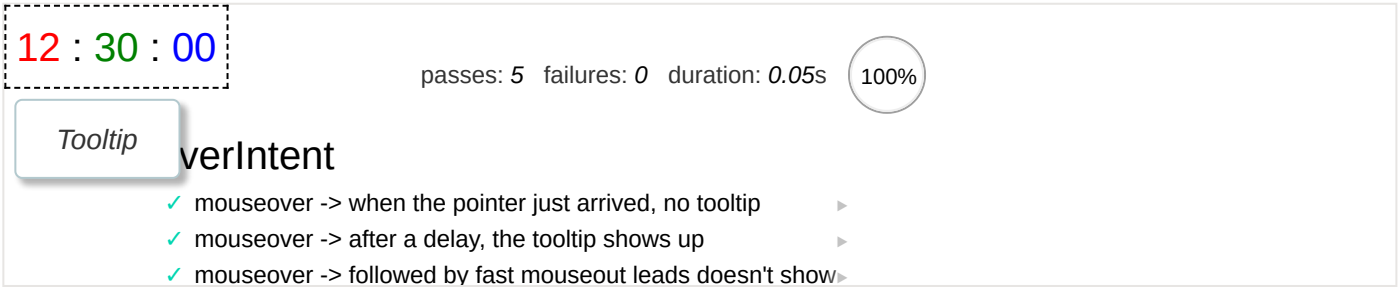
- `elem` – element to track.
- `over` – a function to call if the mouse came to the element: that is, it moves slowly or stopped over it.
- `out` – a function to call when the mouse leaves the element (if `over` was called).

An example of using such object for the tooltip:

```
// a sample tooltip
let tooltip = document.createElement('div');
tooltip.className = "tooltip";
tooltip.innerHTML = "Tooltip";

// the object will track mouse and call over/out
new HoverIntent({
  elem,
  over() {
    tooltip.style.left = elem.getBoundingClientRect().left + 'px';
    tooltip.style.top = elem.getBoundingClientRect().bottom + 5 + 'px';
    document.body.append(tooltip);
  },
  out() {
    tooltip.remove();
  }
});
```

The demo:




If you move the mouse over the "clock" fast then nothing happens, and if you do it slow or stop on them, then there will be a tooltip.

Please note: the tooltip doesn't "blink" when the cursor moves between the clock subelements.

Open a sandbox with tests.

solution

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- If you can't understand something in the article – please elaborate.
- To insert a few words of code, use the `<code>` tag, for several lines – use `<pre>`, for more than 10 lines – use a sandbox (plnkr, JSBin, codepen…)