`flex-grow` is weird. Or is it?

Manuel Matuzovic on Dec 26, 2015 (Updated on Apr 10, 2017)

The following is a guest post by Manuel Matuzovic (https://matuzo.at/) . It illustrates how flex-grow works, weird quirks and all. Then he goes into several examples on how common layout patterns may be implemented using `flex-grow` and `flex-basis`.

When I found out about `flex-grow` , I made a simple demo (https://codepen.io/matuzo/pen/zvXQyj) to find out what it did and how it worked. I thought I got everything figured out, but when I tried it on a website a colleague has recently made, nothing worked as expected. No matter what we did, the layout didn't look and work like it did in my demo. That got me thinking and I started to doubt that I knew what `flex-grow` was all about.

(#how-flex-grow-doesnt-work) How flex-grow *doesn't* work

Before we are going to take a deep dive into the functionality of `flex-grow` , I want to explain to you what I got wrong at first.

I thought that all flex items with `flex-grow` set to `1` would have an equal width. If one of the items had `flex-grow` set to `2` that item would be twice as big as all the others.

This sounds great. It seems as if this is exactly what's happening in the Pen I mentioned before (https://codepen.io/matuzo/pen/zvXQyj) . The parent element is 900px wide, the section with `flex-grow: 2` has a calculated width of 600px and the aside element with `flex-grow: 1` has a calculated width of 300px.

As you can see, everything works out perfectly in this demo, but it did not work at all in a real life example, even though we used the exact same CSS. As it turns out, the problem wasn't the CSS, but the content (or lack of content). The demo I made works, because by only using two empty elements I created a test case that was *too simple* to depict the important specifics of the property.

(#how-flex-grow-really-works) How `flex-grow` really works

I just described how `flex-grow` does *not* work, but I showed you a demo that actually *does do* what I claim it does not (*Later on in this article I will explain the reason for this.*).

To clarify things, let me show you another Pen (https://codepen.io/matuzo/pen/ZQEWjg) . We have got the exact same setup as in the first pen (https://codepen.io/matuzo/pen/zvXQyj) , but this time the section and aside elements aren't empty. Now the ratio isn't 2:1 anymore and the element with flex-grow set to 1 is actually bigger than the element with flex-grow set to 2.

(#explanation) Explanation

If we apply `display: flex;` to the parent element and don't change anything else, the child elements will be stacked horizontally, no matter what. If there isn't enough space, they will shrink in size. If on the other hand there is more than enough space, they won't grow, because Flexbox wants us to define how much they should grow. So rather than telling the browser how wide an element should be, *flex-grow* determines how the remaining space is distributed amongst the flex items and how big the share is each item receives.

Or in other words:

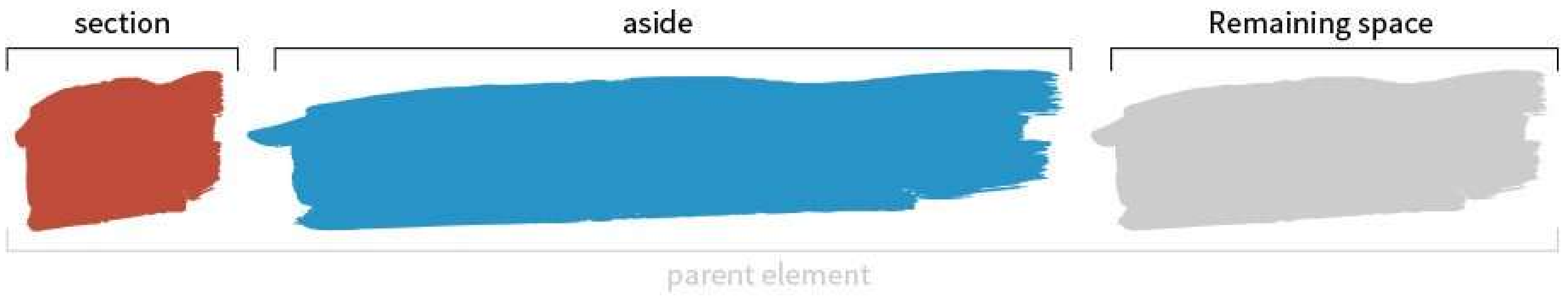
> *A flex container distributes free space to its items (proportionally to their flex grow factor) to fill the containers, or shrinks them (proportionally to their flex shrink factor) to prevent overflow.*

https://drafts.csswg.org/css-flexbox/#flexibility (https://drafts.csswg.org/css-flexbox/#flexibility)

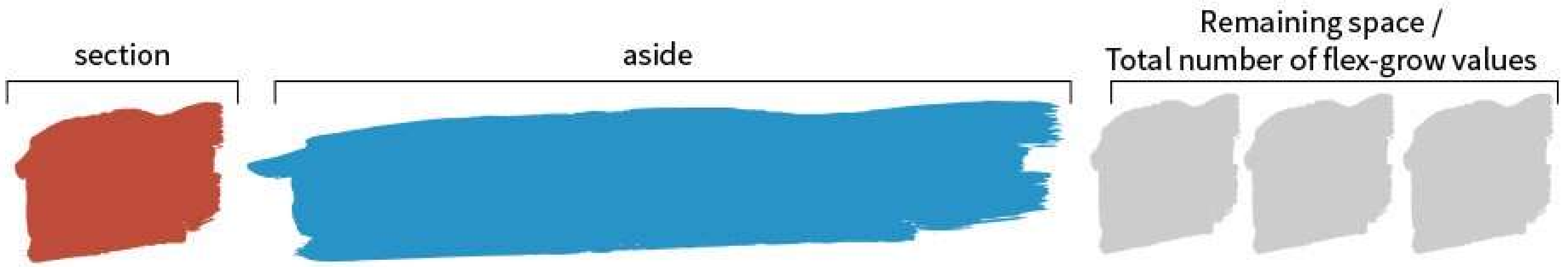
(#demonstration) Demonstration

The concept is much easier to understand if we visualise it.

First we set the `display` property of our parent element to `flex` and by doing that our child elements become flex items and are positioned horizontally next to each other.



Next we decide how many shares of the extra space each element receives. In our previous example the first element receives 2/3 of the remaining space (`flex-grow: 2`) and the second element 1/3 (`flex-grow: 1`). By knowing how many flex-grow values we have in total, we know by which number to divide the remaining space.



Finally we have the number of distributable pieces. Each element receives the appropriate number of pieces based on its `flex-grow` value.

section with flex-grow: 2
aside with flex-grow: 1

(#calculation) Calculation

Theory and visual representations are nice, but let's get dirty and do the math for the above example (https://codepen.io/matuzo/pen/ZQEWjg) .

For our calculation we need 4 numbers: The parent width, the initial width of our section and our aside element and the total number of flex-grow values we'll use.

parent width: **900px**
section width: **99px**
aside width: **623px**
total flex-grow values: **3**

1. First we have to calculate the remaining space

That's pretty easy. We take the parents width and subtract the total initial width of every child element.

```
900 - 99 - 623 = 178
```

parent width – initial section width – initial aside width = remaining space

2. Next we have to determine how much one `flex-grow` is

Now that we have the remaining space we need to determine into how many slices we want to cut it. The important thing here is that we don't divide the remaining space by the number of elements, but by the number of total flex-grow values. So in our case that's 3 (`flex-grow: 2` + `flex-grow: 1`)

```
178 / 3 = 59.33
```

remaining space / total flex-grow values = "one flex-grow"

3. Finally the sliced up remaining space gets distributed between all elements

Based on their flex-grow values the section receives 2 slices (2 * 59.33) and the aside 1 (1 * 59.33). These numbers are added to the initial width of each element.

```
99 + (2 * 59.33) = 217.66 (≈218px)
```

initial section width + (section flex-grow value * "one flex-grow") = new width

and

```
623 + (1 * 59.33) = 682.33 (≈682px)
```

initial aside width + (aside flex-grow value * “one flex-grow”) = new width

Easy cheesy, right?

(#alright-but-why-does-the-first-demo-work) Alright, but why does the first demo work?

We have the formula, now lets find out why we actually got the numbers we wanted in the first Pen (https://codepen.io/matuzo/pen/zvXQyj) even though we didn’t know what we were doing.

parent width: **900px**
section width: **0px**
aside width: **0px**
total flex-grow values: **3**

1. Calculate the remaining space

```
900 - 0 - 0 = 900
```

2. Determine how much *one flex-grow* is

```
900 / 3 = 300
```

3. Distribute the sliced up remaining space

```
0 + (2 * 300) = 600
0 + (1 * 300) = 300
```

If the width of each element is 0, the remaining space equals the actual width of the parent element and thus it looks like `flex-grow` divides the parent element's width in proportional parts.

(#flex-grow-and-flex-basis) `flex-grow` and `flex-basis`

Just a quick recap: `flex-grow` will take the remaining space and divide it by the total amount of flex grow values. The resulting quotient is multiplied by the respective `flex-grow` value and the result is added to each child elements initial width.

But what if there's no remaining space or what if we don't want to rely on the elements initial width, but on a value we set? Can't we still use `flex-grow`?

Of course we can. There is a property called `flex-basis` which defines the initial size of an element. If you use `flex-basis` in conjunction with `flex-grow` the way the widths are calculated changes.

> *<'`flex-basis`'> This component sets the `flex-basis` longhand and specifies the flex basis: the initial main size of the flex item, before free space is distributed according to the flex factors.*

https://drafts.csswg.org/css-flexbox/#valdef-flex-flex-basis (https://drafts.csswg.org/css-flexbox/#valdef-flex-flex-basis)

The big difference if we apply `flex-basis` to an element is that we don't use its initial width in our calculation anymore, but the value of its `flex-basis` property.

I have adapted our previous example by adding `flex-basis` to each element. Here's the Pen (https://codepen.io/matuzo/pen/GoRqOP) for you.

parent width: **900px**
section width: **400px** (flex-basis value)
aside width: **200px** (flex-basis value)
total flex-grow values: **3**

1. Calculate the remaining space

```
900 - 400 - 200 = 300
```

2. Determine how much one flex-grow is

```
300 / 3 = 100
```

3. Distribute the sliced up remaining space

```
400 + (2 * 100) = 600
200 + (1 * 100) = 300
```

Just for the sake of completeness, you don't have to use pixel values and hope for the best, percentages work as well (https://codepen.io/matuzo/pen/pgobag) .

(#working-with-the-box-model) Working with the box model

So to cover everything, let's check out what happens if we add padding and margin. Nothing too special (https://codepen.io/matuzo/pen/Qybgee) actually. In the first step of the calculation you just have to remember to subtract the margins as well.

The only thing to note is that in terms of `box-sizing` `flex-basis` behaves like the `width` property. That means that the calculation as well as the results change if the `box-sizing` property changes (https://codepen.io/matuzo/pen/wMaeVO) . If `box-sizing` was set to `border-box` , you would only work with the `flex-basis` and `margin` values in your calculation, because the `padding` is already included in the width.

(#some-useful-examples) Some useful examples

Alright, enough with the math. Let me give you some examples of how you're able to establish `flex-grow` effectively in your projects.

(#no-more-width-x) No more `width: [ x ]%`

Due to the fact that the remaining space gets distributed automatically, we don't need to think about width values anymore, if we want our child elements to fill the parent element.

Embedded Pen Here

(#the-holy-grail-3-column-liquid-layout-with-pixel-widths) The "Holy Grail" 3 column liquid layout with pixel-widths

Mixing fixed and fluid widths in column layouts is possible with float, but it is neither intuitive or easy nor flexible. Of course with Flexbox and a little *flex-grow* and *flex-basis* magic that is a piece of cake.

Embedded Pen Here

(#filling-remaining-space-with-any-element) Filling remaining space with any element

If you, for example, have an input field next to a label and you want the input field to fill the rest of the space, you don't need ugly hacks anymore.

Embedded Pen Here

You can find more examples on Philip Waltons Solved by Flexbox (https://philipwalton.github.io/solved-by-flexbox/) .

(#listening-to-the-specs) Listening to the specs

According to the specs, we should use the `flex` shorthand rather than `flex-grow` directly.

> *Authors are encouraged to control flexibility using the `flex` shorthand rather than `flex-grow` directly, as the shorthand correctly resets any unspecified components to accommodate common uses.*

https://drafts.csswg.org/css-flexbox/#flex-grow-property (https://drafts.csswg.org/css-flexbox/#flex-grow-property)

But be careful! If you just use `flex: 1;` some of the above examples won't work anymore, because the values set for the *common uses* don't equal the default values and thus interfere with our needs.

If you want to use `flex` for our use case, you should define it like this:

```
flex: 2 1 auto;  /* (<flex-grow> | <flex-shrink> | <flex-basis>) */
```

(#learning-flexbox) Learning Flexbox

If you want to learn more about Flexbox, please check out these great resources:

- A Complete Guide to Flexbox (https://css-tricks.com/snippets/css/a-guide-to-flexbox/) by Chris Coyier (https://css-tricks.com/author/chriscoyier/)
- Flexbox adventures (https://chriswrightdesign.com/experiments/flexbox-adventures/) by Chris Wright (https://chriswrightdesign.com/)
- Flexbox Froggy (http://flexboxfroggy.com/) by Thomas Park (http://thomaspark.co/)
- What the Flexbox? (http://flexbox.io) by Wes Bos (https://wesbos.com/)
- flexboxin5 (https://cvan.io/flexboxin5/)

- Flexbox Tester (http://madebymike.com.au/demos/flexbox-tester/) by Mike Riethmuller (http://madebymike.com.au/)

(#summary-and-lessons-learned) Summary and lessons learned

Is `flex-grow` weird? Nah, not at all. We just have to understand how it works and what it does. If an element has `flex-grow` set to `3` it does not mean that it's 3 times bigger than an element that has `flex-grow` set to 1, but it means that it gets 3 times more pixels added to its initial width than the other element.

I learned my lesson by testing flex-grow with two empty elements (https://codepen.io/matuzo/pen/zvXQyj) , which gave me a completely different understanding of what the property actually does (https://codepen.io/matuzo/pen/ZQEWjg) and this of course led to wrong conclusions. You should check out new stuff in an environment that is as realistic as possible, to get the best impression of how it really works and behaves.