Click to prove you're human

Brushing in D3.js: Selecting Regions with InteractivityBrushing allows users to interactively select regions of interest in a data visualization. This can include selecting discrete elements or zooming-in to specific areas. The d3-brush module provides a simple way to implement this functionality using mouse and touch events.### Brushing for Mouse EventsTo use brushing, create a brush object by calling `d3.brush()` and bind it to an element with the class "brush". You can then add event listeners to detect when the user starts or stops dragging the brush. The brush also updates automatically when the selection changes.For example:```javascriptjsgroup.on(".brush", null);jsgroup.call(d3.brush().on("brush", brushed));```### Programmatic ControlThe brush can be controlled programmatically using various methods, such as `brush.move()` or by listening to end events. You can also use the `brush.extent` property to set the brushable area.### Structure of a BrushA two-dimensional brush consists of several SVG elements:* ``: The outermost group element that contains all other elements.* ``: The overlay rect covers the brushable area defined by `brush.extent`.* ``: The selection rect covers the area defined by the current brush selection.* Several `` elements with different classes (e.g., "handle", "handle--n", etc.): These handle rects cover the edges and corners of the brush selection, allowing users to modify the corresponding values interactively.### Example UsageHere's an example that creates a new two-dimensional brush along the x-axis:```javascriptd3.brushX([0, 100]) .on("brush", brushed)```Similarly, you can create an x-brush or y-brush using `brushX()` or `brushY()` methods.The brush.selection property can be set using various methods, including setting an array of points for the extent, specifying a function that returns an array of points, or using other methods such as filter, touchable, keyModifiers, handleSize, and on.brushSelection(node) Examples Source Returns the current brush selection for the specified node. Internally, an elements brush state is stored as element.__brush; however, you should use this method rather than accessing it directly. If the given node has no selection, returns null. Otherwise, the selection is defined as an array of numbers. For a two-dimensional brush, it is [[x0, y0], [x1, y1]], where x0 is the minimum x-value, y0 is the minimum y-value, x1 is the maximum x-value, and y1 is the maximum y-value. For an x-brush, it is [x0, x1]; for a y-brush, it is [y0, y1].Brush events When a brush event listener is invoked, it receives the current brush event. The event object exposes several fields:target - the associated brush behavior.type - the string start, brush or end; see brush.on.selection - the current brush selection.sourceEvent - the underlying input event, such as mousemove or touchmove.mode - the string drag, space, handle or center; the mode of the brush. For interaction, selections allow listening for and dispatching of events.selection.on(typenames, listener, options) Source Adds or removes a listener to each selected element for the specified event typenames.jsd3.selectAll("p").on("click", (event) => console.log(event))The typenames is a string event type, such as click, mouseover, or submit; any DOM event type supported by your browser may be used. The type may be optionally followed by a period (.) and a name; the optional name allows multiple callbacks to be registered to receive events of the same type, such as click.foo and click.bar. To specify multiple typenames, separate typenames with spaces, such as input change or click.foo click.bar.When a specified event is dispatched on a selected element, the specified listener will be evaluated for the element, being passed the current event (event) and the current datum (d), with this as the current DOM element (event.currentTarget). Listeners always see the latest datum for their element. Note: while you can use event.pageX and event.pageY directly, it is often convenient to transform the event position to the local coordinate system of the element that received the event using d3.pointer.If an event listener was previously registered for the same typename on a selected element, the old listener is removed before the new listener is added. To remove a listener, pass null as the listener. To remove all listeners for a given name, pass null as the listener and .foo as the typename, where foo is the name; to remove all listeners with no name, specify . as the typename.An optional options object may specify characteristics about the event listener, such as whether it is capturing or passive; see element.addEventListener.If a listener is not specified, returns the currently-assigned listener for the specified event typename on the first (non-null) selected element, if any. If multiple typenames are specified, the first matching listener is returned.selection.dispatch(type, parameters) Source Dispatches a custom event of the specified type to each selected element, in order.jsd3.select("p").dispatch("click")An optional parameters object may be specified to set additional properties of the event. It may contain the following fields:bubbles - if true, the event is dispatched to ancestors in reverse tree order.cancelable - if true, event.preventDefault is allowed.detail - any custom data associated with the event.If parameters is a function, it is evaluated for each selected element, in order, being passed the current datum (d), the current index (i), and the current group (nodes), with this as the current DOM element (nodes[i]). It must return the parameters for the current element.pointer(event, target) Source Returns a two-element array of numbers [x, y] representing the coordinates of the specified event relative to the specified target.jsconst [x, y] = d3.pointer(event);event can be a MouseEvent, a PointerEvent, a Touch, or a custom event holding a UIEvent as event.sourceEvent.If target is not specified, it defaults to the source events currentTarget property, if available. If the target is an SVG element, the events The inverse of the screen coordinate transformation matrix is used to transform points, translating coordinates relative to the top-left corner of a target element's bounding client rectangle. This translates the coordinate system only within the client coordinates, as stated in GeometryUtils.For touch events, the returned array of positions corresponds to the event.touches array; for other events, it returns a single-element array. If the target is not specified, it defaults to the source event's currentTarget property.D3 (D3.js) is a free, open-source JavaScript library for visualizing data, offering flexibility in authoring dynamic graphics through its low-level approach built on web standards. It has powered groundbreaking and award-winning visualizations for over a decade, becoming a foundational building block of higher-level chart libraries and fostering a vibrant community around the world.The IEEE VIS 2021 Test of Time Award noted that D3 helped bring data visualization to the mainstream by creating an easy-to-use framework for web developers to author interactive visualizations. D3 was created by Mike Bostock in 2011, with contributions from Jason Davies and Philippe Rivire over the years.D3 is not a charting library but rather a low-level toolbox, composed of 30 discrete libraries that can be used independently or bundled together for convenience. Each piece can be learned individually before being combined to create visualizations. The documentation and examples are recommended to explore what's relevant for each user.D3 is used for creating custom data-driven documents, not replacing high-level charting libraries.It requires low-level control, which can be overwhelming, but offers flexibility and customization options.D3 doesn't have a default presentation of data; users need to write their own code or copy from examples.The library focuses on working with web standards like SVG and Canvas, making it easy to integrate with other tools and frameworks.D3 is suitable for bespoke visualization projects that demand maximum expressiveness and control.However, for simpler tasks or high-level charting needs, libraries like Plot might be a better choice.Users can combine D3 and Plot for the best of both worlds, leveraging their strengths in different areas.Ultimately, D3's complexity and flexibility make it an attractive option for those willing to invest time in learning its intricacies.D3's Data Join is Key to Dynamic Visualizations, Not Overkill for Small ProjectsDon't get swayed by elaborate examples; many of them require immense effort to implement. When time is a constraint, you'll likely create better visuals or analyses with Observable Plot. D3's most innovative feature is its data join, which allows you to apply separate operations for entering, updating, and exiting elements.d3.selectAll("div") .data(data, function(d) { return d ? d.name : this.id; }) .text(d => d.number);This example key function uses the datum d if present, and otherwise falls back to the elements id property. Since these elements were not previously bound to data, the datum d is null when the key function is evaluated on selected elements, and non-null when the key function is evaluated on the new data.div elements created previously with a new array of numbers:jsdiv = div.data([1, 2, 4, 8, 16, 32], d => d);Since a key function was specified (as the identity function), and the new data contains the numbers [4, 8, 16] which match existing elements in the document, the update selection contains three DIV elements. Leaving those elements as-is, we can append new elements for [1, 2, 32] using the enter selection:jsdiv.enter().append("div").text(d => d);Likewise, to remove the exiting elements [15, 23, 42]:Now the document body looks like this:html1 2 4 8 16 32The order of the DOM elements matches the order of the data because the old datas order and the new datas order were consistent. If the new datas order is different, use selection.order to reorder the elements in the DOM. See the general update pattern notebook for more on data joins.selection.datum(value) Source Gets or sets the bound data for each selected element. Unlike selection.data, this method does not compute a join and does not affect indexes or the enter and exit selections.If a value is specified, sets the elements bound data to the specified value on all selected elements. If the value is a constant, all elements are given the same datum; otherwise, if the value is a function, it is evaluated for each selected element, in order, being passed the current datum (d), the current index (i), and the current group (nodes), with this as the current DOM element (nodes[i]). The function is then used to set each elements new data. A null value will delete the bound data.If a value is not specified, returns the bound datum for the first (non-null) element in the selection. This is generally useful only if you know the selection contains exactly one element.This method is useful for accessing HTML5 custom data attributes. For example, given the following elements:html Shawn Allen Mike Bostock You can expose the custom data attributes by setting each elements data as the built-in dataset property:jsselection.datum(function() { return this.dataset; })selection.merge(other) Source Returns a new selection merging this selection with the specified other selection or transition. The returned selection has the same number of groups and the same parents as this selection. Any missing (null) elements in this selection are filled with the corresponding element, if present (not null), from the specified selection. (If the other selection has additional groups or parents, they are ignored.)This method is used internally by selection.join to merge the enter and update selections after binding data. You can also merge explicitly, although note that since merging is based on element index, you should use operations that preserve index, such as selection.select instead of selection.filter. For example:jsconst odd = selection.select(function(d, i) { return i & 1 ? this : null; }); const even = selection.select(function(d, i) { return i & 1 ? null : this; }); const merged = odd.merge(even);See selection.data for more.This method is not intended for concatenating arbitrary selections, however: if both this selection and the specified other selection have (non-null) elements at the same index, this selections element is returned in the merge and the other selections element is ignored. D3 is a collection of modules that are designed to work together; you can use the modules independently, or you can use them together as part of the default build.d3-array Array manipulation, ordering, searching, summarizing, etc.Add Add floating point values with full precision.new Adder - create a full precision adder.adder.add - add a value to an adder.adder.valueOf - get the double-precision representation of an adders value.fcumsum - compute a full precision cumulative summation of numbers.fsum - compute a full precision summation of an iterable of numbers.Bin Bin discrete samples into continuous, non-overlapping intervals.Bisect Quickly find a value in a sorted array.bisector - bisect using an accessor or comparator.bisector.right - bisectRight, with the given comparator.bisector.left - bisectLeft, with the given comparator.bisector.center - binary search for a value in a sorted array.bisect - binary search for a value in a sorted array.bisectRightd3.js library contains numerous functions for data manipulation and visualization, including algorithms for searching, sorting, summarizing, and analyzing arrays. Binary search functions like `bisectLeft` and `bisectCenter` enable efficient value location in sorted arrays. The library also provides various methods for summarizing datasets, such as calculating minimums, maximums, means, medians, modes, and quantiles. Additionally, d3.js offers functionality for logical operations on sets, grouping discrete values, creating interned maps and sets, and generating representative values from continuous intervals.Data transformations can be achieved using functions like `d3.transform`, while the library's `d3.axis` module provides human-readable reference marks for scales. For visualizations involving mouse or touch input, d3.js offers tools like `d3-brush` for selecting regions and `d3-drag` for drag-and-drop functionality.Data loading and parsing are also facilitated through functions such as `d3.csv`, `d3.json`, `d3.svg`, and others that allow for the retrieval of various file types. Furthermore, d3.js provides methods for working with geographic data, including projections, paths, and math-related operations. The library's functionality extends to spherical projections and streams.The diversity of tools within the d3.js library caters to a wide range of tasks in data manipulation and visualization, from simple array calculations to complex graph layouts using force-directed algorithms like velocity Verlet integration.Spherical math provides a range of functions to compute properties of spherical geometry, including areas, bounding boxes, centroids, distances, lengths, and more. d3.geoArea computes the spherical area of a given feature, while d3.geoBounds generates the latitude-longitude bounding box for a specific feature.To further analyze the spatial data, d3.geoCentroid calculates the spherical centroid of a feature, providing insight into its central location. Similarly, d3.geoDistance measures the great-arc distance between two points, which is essential for calculating distances and sizes in spherical geometry.For more complex shapes, d3.geoLength computes the length of a line string or the perimeter of a polygon, ensuring accurate measurements. Additionally, d3.geoInterpolate allows users to interpolate between two points along a great arc, creating smooth transitions and curves.To create visualizations, d3-hierarchy provides layout algorithms for hierarchical data, while d3-interpolate offers interpolation functions for various data types, including numbers, colors, strings, arrays, and objects.Furthermore, d3-path enables the serialization of Canvas path commands to SVG, making it easier to integrate graphics into web applications. The d3-polygon module provides geometric operations for two-dimensional polygons, such as union, difference, and intersection.For generating random data, d3-random offers various distributions, including uniform, normal, and exponential. D3-scale encodes abstract data to visual representations using linear, pow, log, symlog, time, sequential, diverging, quantile, threshold, ordinal, band, point, and categorical scales.To visualize data, d3-shape provides graphical primitives like arcs, pies, lines, areas, curves, symbols, stacks, and more. The d3-time module handles calculations for humanity's peculiar conventions of time, including intervals, dates, and times in various formats.Looking at the way time intervals are structured in D3, we have different kinds of time measurements such as week interval, UTC time, milliseconds, seconds, minutes, hours, days, and weeks. Each of these has its own set of aliases or synonyms that make working with them easier.For instance, when it comes to scheduling timers in D3, you can use the d3.timeout method, which allows you to schedule a timer that stops on its first callback. Similarly, the d3.interval method lets you create a timer that's called with a configurable period.However, dealing with projections and geometry is where things get more complex. When mapping points from the sphere to the plane, you have to consider geodesics, which are segments of great circles, not just straight lines. This means that projections like the Mercator projection require interpolation along each arc to ensure accuracy.The problem becomes even more complicated when dealing with discrete geometry like polygons and polylines. Spherical polygons have unique characteristics such as winding orders for interior rings and cutting or clipping geometry across the antimeridian.D3 uses spherical GeoJSON to represent geographic features, and it supports a wide range of map projections. But navigating these complexities can be overwhelming, especially for those new to D3's time handling and projection capabilities.D3 uses spherical geometry to represent data, and you can apply any aspect to any projection by rotating geometry. There are several features available for working with D3, including Paths - generate SVG path data from GeoJSON, Projections - project spherical geometry to the plane, Streams - transform (either spherical or planar) geometry, Shapes - generate circles, lines, and other spherical geometry, and Spherical math - low-level methods for spherical geometry.It's worth noting that D3's winding order convention is used by TopoJSON and ESRI shapefiles, but it's the opposite convention of GeoJSON's RFC 7946. Additionally, standard GeoJSON WGS84 uses planar equirectangular coordinates, not spherical coordinates, so stitching may be required to remove antimeridian cuts.D3 can be used in any JavaScript environment, including online code editors like Observable, which provides a simple way to get started with D3 and gets help. In Observable, you can create charts by returning the generated DOM element from a cell. The provided example includes a blank chart for getting started.For more complete examples, you can use one of the starter templates available in Observable, including area charts, bar charts, donut charts, histograms, line charts, and more. The D3 gallery also provides many examples, as well as convenient sample datasets to try out D3 features. You can also upload a CSV or JSON file to start playing with your data.D3 is free for public use and can be loaded from a CDN such as jsDelivr or downloaded locally. The recommended way to load D3 is from the CDN-hosted ES module bundle, which exports the d3 global when loaded as a plain script.const svg = d3.create("svg") .attr("width", width) .attr("height", height);###ENDARTICLEd3-format provides a way to customize number formatting for human consumption, similar to Python's format specification mini-language (PEP 3101). The d3-format function takes a specifier string as an argument, which defines the desired format.For example, to format numbers with one decimal place and commas as thousand separators, you can use the following code:```const f = d3.format(".1f");for (let i = 0; i < 10; ++i) { console.log(f(0.1 * i));}```This will output: `0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9`You can also use the `d3.formatPrefix` function to define a custom prefix for numbers, like this:```const f = d3.formatPrefix(",.0", 1e-6);```This will format numbers with commas as thousand separators and six decimal places.Additionally, you can customize the formatting options using the `d3.formatLocale` function, which returns a locale object that defines various formatting options such as decimal point, thousands separator, grouping, currency prefix and suffix, numerals, percent sign, minus sign, and not-a-number value.d3.formatDefaultLocale() is used to set the default locale for formatting numbers in d3.js. It allows for customizing the thousands separator and other format options. The function takes an object with properties such as `thousands` which specifies the character to use for grouping, `grouping` which defines the groups of digits, and `currency` which is used for currency symbols.This method returns a formatter with a consistent SI prefix instead of dynamically computing the prefix for each number. The precision in the specifier represents the number of digits past the decimal point, not significant digits. For instance, `d3.formatPrefix(",.0", 1e-6)` formats numbers as follows: `f(0.00042)` returns `"420"` and `f(0.0042)` returns `"4,200"`. This approach is useful for formatting multiple numbers in the same units for easy comparison. The `precisionPrefix` method helps determine an appropriate precision.The `formatSpecifier(specifier)` function parses the specified specifier and returns an object with exposed fields corresponding to the format specification mini-language and a `toString` method that reconstructs the specifier. For example, parsing `"s"` returns: `{ "fill": " ", "align": ">", "sign": "-", "symbol": "", "zero": false, "width": undefined, "comma": false, "precision": undefined, "trim": false, "type": "s" }`. This method is useful for understanding how format specifiers are parsed and deriving new specifiers.The `d3.FormatSpecifier(specifier)` function creates a new specifier object with exposed fields corresponding to the format specification mini-language and a `toString` method that reconstructs the specifier. For example, creating a new specifier from an object `{type: "f", precision: 1}` returns: `{ "fill": " ", "align": ">", "sign": "-", "symbol": "", "zero": false, "width": undefined, "comma": false, "precision": 1, "trim": false, "type": "f" }`.The `d3.precisionFixed(step)` function returns a suggested decimal precision for fixed point notation given the specified numeric step value. The step represents the minimum absolute difference between values that will be formatted. For example, given numbers 1, 1.5, and 2 with a step of 0.5, the suggested precision is 1: `d3.format("." + p + "f")` formats these numbers as `"1.0"`, `"1.5"`, and `"2.0"`.The `d3.precisionPrefix(step, value)` function returns a suggested decimal precision for use with locale.formatPrefix given the specified numeric step and reference value. The step represents the minimum absolute difference between values that will be formatted, and value determines which SI prefix will be used. For example, given numbers 1.1e6, 1.2e6, and 1.3e6 with a step of 1e5 and a value of 1.3e6, the suggested precision is 1: `d3.formatPrefix("." + p, 1.3e6)` formats these numbers as `"1.1M"`, `"1.2M"`, and `"1.3M"`.The `d3.precisionRound(step, max)` function returns a suggested decimal precision for format types that round to significant digits given the specified numeric step and max values. The step represents the minimum absolute difference between values that will be formatted, and the max represents the largest absolute value that will be formatted. For example, given numbers 0.99, 1.0, and 1.01 with a step of 0.01 and a max of 1.01, the suggested precision is 3: `d3.format("." + p + "r")` formats these numbers as `"0.990"`, `"1.00"`, and `"1.01"`.d3.precisionRound(0.1, 1.1); const f = d3.format("." + p + "r"); f(0.9); // "0.90" f(1.0); // "1.0" f(1.1); // "1.10"

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