

# Package ‘animate’

May 7, 2026

**Title** A Web-Based Graphics Device for Animated Visualisations

**Version** 0.3.9.4

**Description** Implements a web-based graphics device for animated visualisations.

Modelled on the 'base' syntax, it extends the 'base' graphics functions to support frame-by-frame animation and keyframes animation.

The target use cases are real-time animated visualisations, including agent-based models, dynamical systems, and animated diagrams.

The generated visualisations can be deployed as GIF images / MP4 videos, as 'Shiny' apps (with interactivity) or as HTML documents through embedding into R Markdown documents.

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**URL** <https://kcf-jackson.github.io/animate/>

**BugReports** <https://github.com/kcf-jackson/animate/issues>

**Encoding** UTF-8

**RoxygenNote** 7.2.3

**Imports** R6, httpuv, base64enc, jsonlite, glue, R.utils

**Suggests** rmarkdown, knitr, shiny, htmltools, pryr, V8, servr

**VignetteBuilder** knitr

**NeedsCompilation** no

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**Repository** CRAN

**Date/Publication** 2023-02-03 10:42:32 UTC

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---

### Description

Extends the 'base' graphics functions to support frame-by-frame animation and keyframes animation.

### Public fields

connection A handle for the WebSocket connection.

ready\_state The ready state of the connection.

shiny TRUE or FALSE; whether the device is used with in a 'Shiny' app.

session A 'Shiny' session.

virtual\_meta A list of device metadata.

virtual\_session A virtual session simulated with 'V8'.

event\_handlers A named list of user-defined functions for handling events.

### Methods

#### Public methods:

- [animate\\$new\(\)](#)
- [animate\\$off\(\)](#)
- [animate\\$send\(\)](#)
- [animate\\$set\\_max\\_stacksize\(\)](#)
- [animate\\$svg\(\)](#)
- [animate\\$bars\(\)](#)
- [animate\\$objects\(\)](#)
- [animate\\$plot\(\)](#)
- [animate\\$points\(\)](#)
- [animate\\$lines\(\)](#)

- `animate$abline()`
- `animate$axis()`
- `animate$text()`
- `animate$image()`
- `animate$event()`
- `animate$chain()`
- `animate$simple_event()`
- `animate$set()`
- `animate$par()`
- `animate$remove()`
- `animate$clear()`
- `animate$delete()`
- `animate$import()`
- `animate$export()`
- `animate$record()`
- `animate$observeAnimateEvent()`
- `animate$clone()`

**Method** `new()`: Constructor of the device

*Usage:*

```
animate$new(width, height, id = "SVG_1", launch.browser, ...)
```

*Arguments:*

`width` An integer; the width in pixels.

`height` An integer; the height in pixels.

`id` A character string; the id assigned to the device.

`launch.browser` A function to launch a viewer; two options are `rstudioapi::viewer` and `utils::browseURL`. It defaults to the first option if the user is using RStudio and to the second option otherwise. The default applies to interactive session only.

`...` Additional arguments. Use `virtual = TRUE` to use the virtual device, `shiny = TRUE` for shiny application; everything else will be passed to the SVG element that hosts the visualisation.

*Examples:*

```
\donttest{
library(animate)
device <- animate$new(400, 400) # Launch a WebSocket server
attach(device)
x <- 1:10
y <- 1:10
id <- new_id(x) # Give each point an ID: c("ID-1", "ID-2", ..., "ID-10")
plot(x, y, id = id)

new_y <- 10:1
plot(x, new_y, id = id, transition = TRUE) # Use transition
off()
detach(device)
}
```

**Method** `off()`: Switch off the device; this function closes the WebSocket connection.

*Usage:*

```
animate$off()
```

**Method** `send()`: Send commands to device

*Usage:*

```
animate$send(message)
```

*Arguments:*

`message` The message to send to the device.

**Method** `set_max_stacksize()`: Set the maximum size of the stack

*Usage:*

```
animate$set_max_stacksize(n)
```

*Arguments:*

`n` The number of commands the plot stack can hold. Use -1 for unlimited number of commands.

**Method** `svg()`: Initialise a SVG element

*Usage:*

```
animate$svg(width = 800, height = 600, ...)
```

*Arguments:*

`width` Width of the canvas in pixels.

`height` Height of the canvas in pixels.

`...` Additional parameters. Some commonly used parameters are `id` and `root`. `id` assigns an id to the SVG element for future reference; `root` specifies the DOM element to insert the SVG element into.

**Method** `bars()`: Add bars to a plot

*Usage:*

```
animate$bars(x, y, w, h, ...)
```

*Arguments:*

`x` The x coordinates of the bars.

`y` The y coordinates of the bars.

`w` The width of the bars.

`h` The height of the bars.

`...` Additional graphical parameters.

**Method** `objects()`: Add HTML objects to a plot

*Usage:*

```
animate$objects(x, y, w, h, content, ...)
```

*Arguments:*

`x` The x coordinates of the objects.

`y` The y coordinates of the objects.

w The width of the objects.  
h The height of the objects.  
content The content of the objects; the HTML string.  
... Additional graphical parameters.

**Method** plot(): Generic X-Y plotting

*Usage:*

```
animate$plot(x, y, type = "p", ...)
```

*Arguments:*

x The x coordinates of the data.  
y The y coordinates of the data.  
type Type of the plot; one of 'p' and 'l'.  
... Additional graphical parameters.

**Method** points(): Add points to a plot

*Usage:*

```
animate$points(x, y, ...)
```

*Arguments:*

x The x coordinates of the points.  
y The y coordinates of the points.  
... Additional graphical parameters.

*Details:* Options for the "pch" parameter: "circle", "plus", "diamond", "square", "star", "triangle", "wye", "triangle\_down", "triangle\_left", "triangle\_right", "diamond\_alt", "diamond\_square", "pentagon", "hexagon", "hexagon\_alt", "octagon", "octagon\_alt", "cross".

The unit of the "cex" parameter is squared pixels, corresponding to how much pixel space the symbol would cover. The convention comes from the 'D3' library, and the choice is (believed) to make plots visually consistent across the different symbols.

**Method** lines(): Add line segments / paths to a plot

*Usage:*

```
animate$lines(x, y, ...)
```

*Arguments:*

x The x coordinates of the line.  
y The y coordinates of the line.  
... Additional graphical parameters.

**Method** abline(): Add straight lines to a plot

*Usage:*

```
animate$abline(a, b, h, v, ...)
```

*Arguments:*

a The intercept.  
b The slope.  
h The y-value(s) for horizontal line(s).

v The x-value(s) for vertical line(s).  
... Additional graphical parameters.

**Method** `axis()`: Add an axis to a plot

*Usage:*

```
animate$axis(x, ...)
```

*Arguments:*

x The x coordinates of the text.  
... Additional graphical parameters.  
y The y coordinates of the text.  
labels The text.

**Method** `text()`: Add text to a plot

*Usage:*

```
animate$text(x, y, labels, ...)
```

*Arguments:*

x The x coordinates of the text.  
y The y coordinates of the text.  
labels The text.  
... Additional graphical parameters.

**Method** `image()`: Add background image to a plot

*Usage:*

```
animate$image(href, width, height, ...)
```

*Arguments:*

href The link to the image.  
width The width of the image.  
height The height of the image.  
... Additional graphical parameters.

**Method** `event()`: Attach an interactive event to an element

*Usage:*

```
animate$event(selector, event_type, callback)
```

*Arguments:*

selector A character string; a CSS selector.  
event\_type A character string; the event type. For example, "click", "mouseover", "mouseout". See more options at [https://www.w3schools.com/jsref/dom\\_obj\\_event.asp](https://www.w3schools.com/jsref/dom_obj_event.asp).  
callback A function, to be called when the event is triggered. The function should take an argument to receive the data from the browser end.

**Method** `chain()`: Chain a transition after another.

*Usage:*

```
animate$chain(callback)
```

*Arguments:*

`callback` A function, to be called when the event is triggered. The function should take an argument to receive the data from the browser end.

*Examples:*

```
\donttest{
library(animate)
device <- animate$new(600, 600) # Launch a WebSocket server
attach(device)
par(xlim = c(0, 10), ylim = c(0, 10))
plot(1:10, 1:10, id = 1:10)
points(1:10, sample(10, 10), id = 1:10,
  transition = list(
    duration = 1000,
    on = chain(function(message) {
      print(message)
      points(1:10, sample(10, 10), id = 1:10, bg = "green",
        transition = list(duration = 2000))
    })
  ))
par(xlim = NULL, ylim = NULL) # Reset `xlim` and `ylim` in `par`
off()
detach(device)
}
```

**Method** `simple_event()`: Attach a captured event to an element

*Usage:*

```
animate$simple_event(selector, event_type, method, param)
```

*Arguments:*

`selector` A character string; a CSS selector.

`event_type` A character string; the event type. For example, "click", "mouseover", "mouseout". See more options at [https://www.w3schools.com/jsref/dom\\_obj\\_event.asp](https://www.w3schools.com/jsref/dom_obj_event.asp).

`method` A character string; the name of a device function (e.g. "points").

`param` A named list of arguments to be called with.

**Method** `set()`: Set the active device to a SVG element

*Usage:*

```
animate$set(device_id)
```

*Arguments:*

`device_id` A character vector; ID of the device.

**Method** `par()`: Set the graphical parameters

*Usage:*

```
animate$par(...)
```

*Arguments:*

... The graphical parameters

**Method** `remove()`: Remove elements from the active SVG element

*Usage:*

```
animate$remove(id = NULL, selector = "*")
```

*Arguments:*

`id` A character vector; the ID of the elements.

`selector` A character vector; a CSS selector.

**Method** `clear()`: Remove all elements from the active SVG element

*Usage:*

```
animate$clear()
```

**Method** `delete()`: Remove a SVG element

*Usage:*

```
animate$delete(id = NULL)
```

*Arguments:*

`id` A character string; the ID of the SVG. If not provided, remove the active SVG element. `#' @description #'` Perform a group of graphical operations to a plot `#' @param ...` Any number of graphical operations. `group = function(...) self$send(Message("fn_group", c(...)))`,  
,

**Method** `import()`: Import an animated plot

*Usage:*

```
animate$import(setting)
```

*Arguments:*

`setting` A JSON file exported from previous runs.

**Method** `export()`: Export an animated plot

*Usage:*

```
animate$export(path = "./animate.json", handler = "browser")
```

*Arguments:*

`path` A character string; the file path to export to.

`handler` `'r'` or `'browser'`; the program to handle the export operation.

**Method** `record()`: Record an animated plot as a MP4 video

*Usage:*

```
animate$record()
```

*Details:* This function will prompt you to select a screen / window / tab to record. Once started, the recording can be stopped by using the stop button at the notification box, or clicking anywhere on the page near the device. Always confirm that the screen recording notification box is gone. The captured video will be downloaded right after the recording stops.

This uses web browsers' Media Streams API to record the screen and return the captured frames as a video. The entire process runs locally. The source file that provides this functionality can be found at `system.file("addons/screen_record.js", package = "animate")`.

This function is disabled for 'Shiny' app and R Markdown document.

This function does not work in the RStudio viewer. Please use the "show in new window" button to launch the page with a web browser.

See browser compatibility at: [https://developer.mozilla.org/en-US/docs/Web/API/MediaStream\\_Recording\\_API#browser\\_compatibility](https://developer.mozilla.org/en-US/docs/Web/API/MediaStream_Recording_API#browser_compatibility)

See Media Streams API reference at: [https://developer.mozilla.org/en-US/docs/Web/API/Media\\_Streams\\_API](https://developer.mozilla.org/en-US/docs/Web/API/Media_Streams_API)

**Method** `observeAnimateEvent()`: Event handler

*Usage:*

```
animate$observeAnimateEvent(input)
```

*Arguments:*

`input` The input object in the server function of a 'Shiny' app.

**Method** `clone()`: The objects of this class are cloneable with this method.

*Usage:*

```
animate$clone(deep = FALSE)
```

*Arguments:*

`deep` Whether to make a deep clone.

## Note

This function differs from the event function in that events registered through `simple_event` do not require R at deployment to work.

## Examples

```
## -----
## Method `animate$new`
## -----

library(animate)
device <- animate$new(400, 400) # Launch a WebSocket server
attach(device)
x <- 1:10
y <- 1:10
id <- new_id(x) # Give each point an ID: c("ID-1", "ID-2", ..., "ID-10")
plot(x, y, id = id)

new_y <- 10:1
plot(x, new_y, id = id, transition = TRUE) # Use transition
off()
detach(device)

## -----
## Method `animate$chain`
## -----
```

```

library(animate)
device <- animate$new(600, 600) # Launch a WebSocket server
attach(device)
par(xlim = c(0, 10), ylim = c(0, 10))
plot(1:10, 1:10, id = 1:10)
points(1:10, sample(10, 10), id = 1:10,
  transition = list(
    duration = 1000,
    on = chain(function(message) {
      print(message)
      points(1:10, sample(10, 10), id = 1:10, bg = "green",
        transition = list(duration = 2000))
    })
  ))
par(xlim = NULL, ylim = NULL) # Reset `xlim` and `ylim` in `par`
off()
detach(device)

```

---

animateDependencies    *The HTML dependency of an 'animate' plot*

---

### Description

The HTML dependency of an 'animate' plot

### Usage

```
animateDependencies()
```

---

animateOutput    *Create an animate output (container) element*

---

### Description

Create an animate output (container) element

### Usage

```

animateOutput(
  outputId = "animateOutput",
  width = "100%",
  height = "400px",
  ...
)

```

**Arguments**

outputId	output variable to read the plot/image from.
width	Width of the plot area. Must be a valid CSS unit (like "100%", "400px", "auto").
height	Height of the plot area. Must be a valid CSS unit (like "100%", "400px", "auto").
...	Optional CSS styling for the container of the plot.

**Note**

(Advanced usage) A "stack\_limit" parameter can be included in the optional parameters to control how many directives the device should keep track of.

**Examples**

```
# Using 'animate' in a 'Shiny' app
library(shiny)

ui <- fluidPage(
  actionButton("buttonPlot", "Plot"),
  actionButton("buttonPoints", "Points"),
  actionButton("buttonLines", "Lines"),
  animateOutput()
)

server <- function(input, output, session) {
  device <- animate$new(600, 400, session = session)
  id <- new_id(1:10)

  observeEvent(input$buttonPlot, { # Example 1
    device$plot(1:10, 1:10, id = id)
  })

  observeEvent(input$buttonPoints, { # Example 2
    device$points(1:10, runif(10, 1, 10), id = id, transition = TRUE)
  })

  observeEvent(input$buttonLines, { # Example 3
    x <- seq(1, 10, 0.1)
    y <- sin(x)
    id <- "line_1"
    device$lines(x, y, id = id)
    for (n in 11:100) {
      x <- seq(1, n, 0.1)
      y <- sin(x)
      device$lines(x, y, id = id)
      Sys.sleep(0.05)
    }
  })
}

# shinyApp(ui = ui, server = server) # Launch the 'Shiny' app
```

---

click_to_loop	<i>Click an element to play all frames</i>
---------------	--

---

**Description**

Playback option for the functions [rmd\\_animate](#) and [insert\\_animate](#).

**Usage**

```
click_to_loop(selector = "#SVG_1", start = 2, wait = 20)
```

**Arguments**

selector	The ID of the DOM element.
start	An integer; the number of frames to execute upon the beginning of the visualisation. This is useful when one wants to start with some set-up instead of an empty canvas.
wait	A number; the number of milliseconds to wait for before the next frame is drawn.

**Examples**

```
input <- tempfile(fileext = ".Rmd")
output <- tempfile(fileext = ".html")
writeLines('
```{r, echo = FALSE, message = FALSE}
# Run / include the following in a code chunk of an R Markdown document
library(animate)
insert_animate(system.file("tests/Lorenz_system.json.gz", package = "animate"),
               options = click_to_loop())
...
', input)
knitr::knit(input, output)
# browseURL(output)
```

---

click_to_play	<i>Click an element to play a frame</i>
---------------	-----------------------------------------

---

**Description**

Playback option for the functions [rmd\\_animate](#) and [insert\\_animate](#).

**Usage**

```
click_to_play(selector = "#SVG_1", start = 2)
```

**Arguments**

selector	The ID of the DOM element.
start	An integer; the number of frames to execute upon the beginning of the visualisation. This is useful when one wants to start with some set-up instead of an empty canvas.

**Examples**

```
input <- tempfile(fileext = ".Rmd")
output <- tempfile(fileext = ".html")
writeLines('
```{r, echo = FALSE, message = FALSE}
# Run / include the following in a code chunk of an R Markdown document
library(animate)
insert_animate(system.file("tests/basic_points.json", package = "animate"),
               options = click_to_play())
...
', input)
knitr::knit(input, output)
# browseURL(output)
```

---

ffmpeg

*Launch the 'FFmpeg'-based video editor ('Shiny' app)*

---

**Description**

Launch the 'FFmpeg'-based video editor ('Shiny' app)

**Usage**

```
ffmpeg()
```

**Note**

This requires ffmpeg to work. The 'ffmpeg' binary can be downloaded from <https://ffmpeg.org/download.html>.

---

ffmpeg_command	<i>'FFmpeg' command builder</i>
----------------	---------------------------------

---

**Description**

'FFmpeg' command builder

**Usage**

```
ffmpeg_command(input, output, ...)
```

**Arguments**

input	A character string; the path to the input video file.
output	A character string; the path to the output video file.
...	Parameters to be passed to the ffmpeg command-line interface.

**Value**

A character string; the 'FFmpeg' command.

---

ffmpeg_shiny	<i>'FFmpeg'-based video editor ('Shiny' app)</i>
--------------	--

---

**Description**

'FFmpeg'-based video editor ('Shiny' app)

**Usage**

```
ffmpeg_shiny()
```

---

insert_animate	<i>Insert an animated plot into an R Markdown document</i>
----------------	--

---

### Description

Insert an animated plot into an R Markdown document

### Usage

```
insert_animate(file, options = click_to_play(), style, use_cdn = TRUE)
```

### Arguments

file	The exported plot.
options	A character string; the JavaScript to customise the playback options. Two basic options <code>click_to_play()</code> and <code>click_to_loop()</code> have been implemented for general usage.
style	Optional style for the iframe that hosts the visualisation.
use_cdn	TRUE / FALSE; if TRUE, serve the assets from a CDN, otherwise embed the assets into the HTML.

### Examples

```
input <- tempfile(fileext = ".Rmd")
output <- tempfile(fileext = ".html")
writeLines('
```{r, echo = FALSE, message = FALSE}
# Run / include the following in a code chunk of an R Markdown document
library(animate)
insert_animate(system.file("tests/Lorenz_system.json.gz", package = "animate"),
               options = click_to_loop())
...
', input)
knitr::knit(input, output)
# browseURL(output)
```

---

loop	<i>Loop through the available frames n times</i>
------	--------------------------------------------------

---

### Description

Playback option for the functions [rmd\\_animate](#) and [insert\\_animate](#).

**Usage**

```
loop(times = 1, wait = 20)
```

**Arguments**

times	An integer; the number of times to loop.
wait	A number; the number of milliseconds to wait for before the next frame is drawn.

**Examples**

```
input <- tempfile(fileext = ".Rmd")
output <- tempfile(fileext = ".html")
writeLines('
```{r, echo = FALSE, message = FALSE}
# Run / include the following in a code chunk of an R Markdown document
library(animate)
insert_animate(system.file("tests/Lorenz_system.json.gz", package = "animate"),
               options = loop(times = 2, wait = 15))
```
', input)
knitr::knit(input, output)
# browseURL(output)
```

---

new\_id

*A utility function for generating IDs*

---

**Description**

A utility function for generating IDs

**Usage**

```
new_id(x, prefix = "ID", sep = "-")
```

**Arguments**

|        |                                                                             |
|--------|-----------------------------------------------------------------------------|
| x      | The data that require IDs.                                                  |
| prefix | A character string; the prefix to be added to each ID.                      |
| sep    | A character string; the separator to be added between the prefix and an ID. |

**Examples**

```
new_id(x = runif(10), prefix = "points")
```

---

rmd\_animate

*In-line rendering of an animated plot in an R Markdown document*


---

## Description

In-line rendering of an animated plot in an R Markdown document

## Usage

```
rmd_animate(device, ...)
```

## Arguments

device            The [animate](#) object.  
 ...                Optional parameters to pass to [insert\\_animate](#).

## Note

This function should only be used in a code chunk of an R Markdown document.

## Examples

```
input <- tempfile(fileext = ".Rmd")
output <- tempfile(fileext = ".html")
writeLines('
```{r, echo = FALSE, message = FALSE}
# Run / include the following in a code chunk of an R Markdown document
library(animate)
device <- animate$new(500, 500, virtual = TRUE) # set `virtual = TRUE` for R Markdown document
attach(device)

# Data
id <- new_id(1:10)
s <- 1:10 * 2 * pi / 10
s2 <- sample(s)

# Plot
par(xlim = c(-2.5, 2.5), ylim = c(-2.5, 2.5))
plot(2*sin(s), 2*cos(s), id = id)
points(sin(s2), cos(s2), id = id, transition = list(duration = 2000))

# Render in-line in an R Markdown document
rmd_animate(device, click_to_play(start = 3)) # begin the plot at the third frame
...
```{r, echo = FALSE, message = FALSE}
par(xlim = NULL, ylim = NULL) # Reset `xlim` and `ylim` in `par`
# Do some other plots
off()
detach(device)
```

```

---
', input)
knitr::knit(input, output)
# browseURL(output)

```

---

websocket

*Start a WebSocket server*

---

## Description

A thin wrapper of the `httpuv` package, modified to serve animated plots.

## Public fields

`app` A list of functions that define the application.

`server` A server handle to be used by `'stopServer'`.

`ws` A WebSocket channel to handle the communication between the R session and the browser session.

`in_handler` A function to handle instructions sent by the browser session.

`port` An integer; the TCP port number.

`connected` TRUE or FALSE; whether a connection has been established. One should start the WebSocket server before launching the web page that connects to the server.

`started` TRUE or FALSE; whether a server has been started. Use the `startServer` method to start a server.

## Methods

### Public methods:

- [websocket\\$startServer\(\)](#)
- [websocket\\$stopServer\(\)](#)
- [websocket\\$listServers\(\)](#)
- [websocket\\$stopAllServers\(\)](#)
- [websocket\\$new\(\)](#)
- [websocket\\$clone\(\)](#)

**Method** `startServer()`: Start a WebSocket server

*Usage:*

```
websocket$startServer()
```

**Method** `stopServer()`: Stop a WebSocket server

*Usage:*

```
websocket$stopServer()
```

**Method** `listServers()`: List all running WebSocket servers

*Usage:*

```
websocket$listServers()
```

**Method** `stopAllServers()`: Stop all running WebSocket servers

*Usage:*

```
websocket$stopAllServers()
```

**Method** `new()`: Initialise a WebSocket connection

*Usage:*

```
websocket$new(in_handler, port = 9454)
```

*Arguments:*

`in_handler` A function to handle incoming message, default to be `print` which only displays the message without any processing.

`port` An integer; the TCP port number.

*Returns:* A 'websocket' object.

**Method** `clone()`: The objects of this class are cloneable with this method.

*Usage:*

```
websocket$clone(deep = FALSE)
```

*Arguments:*

`deep` Whether to make a deep clone.

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