

Resource 4 – Design Technology/Science

Nature inspired design



Key stages

2—3

Creative thinking habit – **Collaborative**

Interdependence in working together, accountability among peers, giving and receiving feedback

Collaborative prompts, questions, and class discussion are marked in teal.



reset

Teaching for creativity

Supporting teachers to develop young people's creativity through a broad and diverse curriculum

**A NEW
DIRECTION**

We create **opportunity**

Introduction

A New Direction is a London-based not-for-profit organisation that generates opportunities for children and young people to develop their creativity.

Of equal priority for us is helping to broaden and diversify the curriculum in response to the combined crises facing young people, including the climate crisis, the call for a more equitable society, prompted most recently by the Black Lives Matter movement, and the COVID-19 pandemic and its associated impact on the economy and wellbeing.

This pack draws on the expertise of London's cultural sector to provide rich learning materials that help develop young people's creativity and their ability to navigate these times. For those schools wishing to provide a broad and balanced curriculum, these thoughtful and engaging learning sequences explore some of the lives of individuals who are new to or under-represented in the curriculum, a focus on Black History in London, lessons that support the new Relationships and Sex Education programme of study, nature-inspired design activities for exploration within KS2 – 3 Design Technology, and pupil investigation in Geography exploring the climate crisis.

The resources employ a variety of strategies which place an emphasis on effective education being an active process that is participative in nature and which develops children's ongoing capacity for learning. As such, they can be used by teachers across the curriculum.

We believe in the possibility of a better world and want to support teachers and educators in doing what you do best. We have consulted with teachers throughout the development of these resources, which are part of a longer-term commitment to generating relevant and accessible learning materials that help us to have braver conversations in the classroom and to articulate the power of creativity.

Writers Seyi Adekun, Butterfly Theatre, Abigail Hunt, London Metropolitan Archives, Climate Museum UK

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A special thank you to the teachers who took the time to read through drafts of this resource and provide feedback during such a busy time.



The five-dimensional model of creative thinking

For creativity to flourish, it needs nurturing and young people need access to excellent resources.

‘Creativity in the classroom does not happen by accident – we need to be deliberate and proactive in developing our pupils’ creative skills and habits. Now more than ever, creative thinking is the key to their future. These resources breathe life into new areas of the curriculum and make explicit the vital and life-giving creative habits which will enable students to thrive in complex times.’

– Bill Lucas

These learning sequences focus on curriculum-linked topics for exploration with creative learning at the heart.

They are underpinned by the Creative Habits of Mind drawn from the five-dimensional creative thinking model and decades of research from Professor Bill Lucas, Professor Guy Claxton and Dr Ellen Spencer.

Creativity is a multi-dimensional idea and education researchers are showing just how valuable Creative Thinking is in helping our pupils learn in an increasingly complex world. The model has been widely adopted into learning policies across the globe, based on years of field trials through the Centre for Real-World Learning at the University of Winchester that included schools participating in Creative Partnerships, the UK government’s flagship creative learning programme (2002 – 2011).

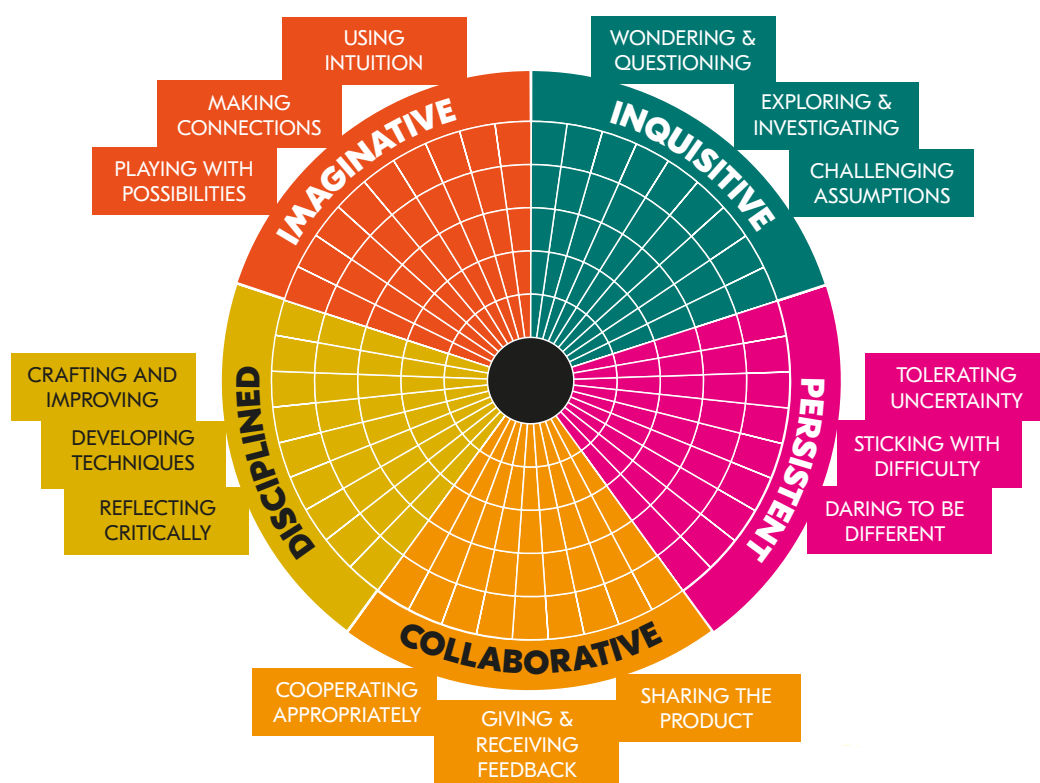
The Centre for Real-World Learning’s model below features five Creative Habits of Mind and offers a means of tracking the development of creativity in pupils.

A New Direction, like many others, believes creativity can be taught and learned, and we want to support schools and teachers to feel equipped to do just this. The five Creative Habits of Mind are drawn out in the resources, each resource making explicit one particular habit with learning strategies and class discussion for pupils to understand the definitions for their own learning and articulate their own skills development.

Professor Bill Lucas

Director of the Centre for Real-World Learning, University of Winchester. Co-chair of the PISA 2021/2022 Test of Creative Thinking. Academic advisor on creativity to Arts Council England. Co-author of more than forty books including the internationally acclaimed, *Teaching Creative Thinking: Developing learners who generate ideas and can think critically*. Curator of Creativity Exchange platform: <https://www.creativityexchange.org.uk/>

Lucas, Bill and Spencer, Ellen (2017) *Teaching Creative Thinking: Developing learners who generate ideas and can think critically*, Carmarthen: Crown House Publishing Ltd



Foreword

I warmly recommend this resource to you. Creativity in education is needed now more than ever.

We need teachers and leaders working within their communities who are focused on 'finding a way through' for all learners. As a headteacher, my own school was fortunate to receive funding as a School of Creativity, this was an initiative building on Creative Partnerships inspired by the work of the late great Sir Ken Robinson. We were able to share so many aspects of an alternative improvement agenda that was built on inclusion, trust and agency with high standards as a by-product replacing a deficit reinforcement of stereotype leading to failure.

Building on decades of rigorous research, the OECD ranks creativity and critical thinking amongst the top skills that our young people need. Teachers and leaders with creative approaches are able to use these skills to constantly navigate the challenges of the education system to positive effect. Having the humility and openness to work alongside artists as part of this leadership opens up new spaces in our collective thinking.

Leading the Chartered College of Teaching, I am committed to building a profession that is confident about being open to new ideas, restless, inventive, persistent about what matters, generous and empathic. All of these dispositions offer states of mind that build capacity for learning amongst our children and young people. I encourage you to absorb these resources in pursuit of this goal.

Professor Dame Alison Peacock

Chief Executive
Chartered College of Teaching

How to use this resource

These resources are designed to put the learner in the driving seat, with open-ended engaging activities, learning strategies and questions to prompt dialogue and debate, critical thinking, and creative response.

They take a **'split-screen' approach** covering both a curriculum area and a creative habit in a single set of activities.

There are three or four lessons in each topic that can be used as standalone activities with the noted minimal duration time or as fuller learning sequences to expand as you see best for your pupils.

To support each resource, you'll find downloadable and printable Appendix material, including differentiation tips for students with SEND and extension activities, hosted on

www.anewdirection.org.uk

You are the experts, and these sequences just build on what you already do – pick from some or all to suit your needs. We would love to hear from you about how you get on, any questions you have, and what you'd like to see more of!

[#letsresettogether](https://twitter.com/letsresettogether)

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Artsmark

If using these resources helps you to develop your curriculum, build skills and knowledge across a range of art forms, and support student voice and wellbeing, you could gain recognition and accreditation with an [Arts Council England Artsmark Award](#). The Artsmark Award is accredited by Arts Council England and presented to schools where arts and culture provision fulfils eight criteria and seven quality principles. It complements your school improvement plan and recognises commitment to a broad and balanced curriculum. Completing the activities in this resource can contribute to your Artsmark journey and provide evidence of impact in a number of areas. Links to each Artsmark criteria are highlighted in an [Appendix](#).

The Artsmark self-assessment framework and a suite of supporting documents are available and free to download on [A New Direction's website](#). Artsmark is a supported journey that connects you to a network of like-minded settings. Talk to the team at A New Direction if you want to find out more.

[#artsmark](https://twitter.com/artsmark)

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Writer Seyi Adelekun — Artist and Creative Practitioner

Duration A learning sequence of 3 lessons plus homework / extension opportunities (2x 90-minute lessons & 1x 1-hour lesson)

Curriculum links:

KS2

Year 6 — Evolution and Inheritance — identify how animals and plants have adapted to suit their environment in different ways, and that adaptation may lead to evolution.

KS3

Design Technology — use a variety of approaches (for example, biomimicry and user-centred design) to generate creative ideas and avoid stereotypical responses.

Science — Relationships in an Ecosystem — the interdependence of organisms, food webs and pollinated crops.

Science — Plant Reproduction — how organisms are affected by their environment.

Science — Evolution and Inheritance — how animals and plants adapt to suit their environment.

Objectives and outcomes

- I can understand what biomimicry is and how it is used in technology to inspire ideas.
- I can connect biomimicry concepts to my observation of plants and animals.
- I have explored how design solutions can be learned from nature.
- I have worked collaboratively to find nature's solutions to a human challenge.
- I have grown in confidence in thinking critically and being able to give and receive feedback.

Nature is one of the best models we have for a sustainable, regenerative way of life, and in learning about nature-inspired design — biomimicry — pupils are encouraged to look at nature with fresh eyes.

In order for people to thrive on a healthy planet, we must have a deeper understanding of nature's biological strategies to help us design human technologies that could solve everyday problems through to issues caused by pollution and climate destruction.

Throughout history, people have taken inspiration from nature to solve human problems and in these three learning sequences, pupils explore and identify some of the time-tested strategies that organisms and ecosystems have used to solve problems over millions of years of adaptation and evolution. Inspired by nature, they will work collaboratively to generate their own design solution.

Being collaborative as a creative habit

Collaboration is an essential part of working creatively and an important life skill that helps us harness the best learning. By working together in this learning sequence, pupils explore what it is possible to achieve when being accountable to each other's skills sets and contributions. Pupil confidence is built through peer feedback as they contribute to the ideas of others and improve their own.

LESSON 1

Exploring design functions in nature

Duration

90 minutes

Resources

- Introduction to biomimicry presentation (resource [Appendix A](#))
- 'Function Lens' activity (resource [Appendix B](#))
- A selection of natural living objects if pupils are unable to go outside e.g. parts of plants, seeds, moss, feathers, fur, shells

Pupils will gain an understanding of what biomimicry is and how it is used in technology to inspire design ideas. They will learn about products that have been designed using biomimicry and recognise that organisms are the way they are (in terms of anatomy, physiology, behaviour) to achieve many functions. They will suspend what they know about an organism to see it with entirely fresh eyes.

Introduction (20 minutes)

Introduce the concept that biomimicry is a practice that learns from and mimics the strategies found in nature to solve human design challenges. Simply put, biomimicry is when people solve problems with ideas from nature.

You can use the presentation ([Appendix A](#)) to help with this.

Explain to the class that in learning from and mimicking nature, we can find solutions for challenges we face in the world and help design sustainable solutions for everyday problems right through to those that have been caused by or are causing the climate crisis.

- *Why should we care about biomimicry?*
- *How can we find out about more familiar examples of biomimicry?*
- *How might we work with a partner to collaborate and contribute our great ideas in these lessons?*

Main activity: Function lens (60 minutes)

Observing nature is an essential part of biomimicry because understanding and experiencing nature allows us to design products inspired by nature. Observing nature will allow us all to recognise and describe the relationship between the traits and functions in nature's organisms.

- *An organism is any plant, animal or other living thing*
- *A trait describes a particular characteristic or attribute of that organism.*
- *A function is the action of an organism. This will also describe the purpose of our human-made design in a later lesson.*

Working in pairs, the class goes on an outdoor expedition round the school grounds or further afield to a local park.

Each pair is set the challenge to observe the functions of plants, and animals if they see them.

(The activity sheet in [Appendix B](#) will help pupils to practise what they will need to do outside with their partner.)

You're going to choose an organism to explore together. If this is a plant or natural object, then use all your senses (EXCEPT taste!): sight, smell, touch and hearing.

If you choose and see an animal, use your sight to observe it but don't disturb it in its natural habitat.

You are *collaborators, working together* to observe and find out all you can about the traits of an organism. Choose together your roles – this might be one of you recording the data that describes the organism while the other draws what they see.

Together with their partner, pupils explore the following questions:

- *Why do you think this organism has this trait?*
- *Looking at its surroundings, what does it have to deal with in nature to survive and reproduce?*
- *Does it need to protect itself from predators?*
- *How does it get its food or what does it need to survive?*

If you have access to computers, the pairs could do further research (either back at school or as homework) about the organisms they observed on websites of organisations such as The Woodland Trust or Wildlife Watch.

Plenary and self-reflection (10 minutes)

Once the class has identified and observed their chosen organism, they return to reflect on the following questions in pairs, then together as a group.

- *What did you figure out? Each person takes it in turns to share for 1 minute without interruption – What part of this process was challenging?*
- *Did you prefer describing the traits or drawing the organism, why?*
- *What new things did you learn about an organism today?*
- *Did you find it helpful investigating the natural world with a partner, why?*
- *How did the two of you work better together than if you had worked alone?*

You are exploring the creative habit of collaboration and that it can enhance our work. In the next lessons you are going to stick with your partner to build on the experience of working together in order to achieve a more productive result.

Let's see just how productive we can be when sparking ideas and thinking of each other.



LESSON 2

Design strategies from nature

Duration

90 minutes, plus homework or extension

Resources

- Pens
- Pencils
- Colouring pencils
- Mini-whiteboards or paper for note-taking
- Biomimicry domino cards (resource [Appendix C](#))
- 'Functions that solve the problem' activity sheet (resource [Appendix D](#))
- Selection of images of natural organisms – e.g. spider, burdock seeds, gecko, sea sponge (asknature.org has a wealth of examples you could use in the classroom)

Partners will work collaboratively to complete a series of design ideas and as they do so, will develop confidence in this way of working. Together, they will discuss potential problems to solve and how plants and animals can help us solve them. They will then start on their own original design task.

Warm-up and introduction (20 minutes)

You can choose either or both of the following:

Biomimicry dominoes – Pupils assess what they have learned and remembered about biomimicry so far.

Prepare 10 examples of biomimicry (or use [Appendix C](#)), each made up of an inspiration from nature and one design end-product. Cut them out as individual files for each pair to work out, or display as an interactive white board whole-class activity in teams.

Every time a pupil matches a correct pair, they should name the inspiration, describe the product solution that has been adopted from nature, and explain why.

Real problems with natural solutions – Introducing real-life problems for pupils to think critically about solutions inspired by nature.

- A **biological strategy** describes how an organism's traits work to perform a particular function.
- A **design strategy** describes how the features of a design or technology work to produce a desired function.

Display a list of real-life problems for the class to talk about together with their partner in order to come up with nature-inspired design solutions. You can prompt where needed towards the suggested solutions below.

Examples

- *You are learning to ride a bike and want to protect your head. What could you design to protect your head?*
- *What is it from nature that inspires your design solution?*
- A retractable helmet with a soft interior and hard exterior.
- A snail-inspired solution because it has a hard, lightweight, curved shell that protects its soft body from predators.
- *You are going on a hike in the forest and want to hide from dangerous animals. What design strategy could help you blend into the environment?*
- *What organism inspired your design?*
- *You are diving in the sea and want to swim deeper underwater to look at the seabed. What design strategy could help you swim better underwater?*
- *What organism inspired your design?*

Activity 1: Asking nature (10 minutes)

Partners are presented with the challenge in this lesson, and the next, to work together to design a gadget inspired by nature that will solve a problem in their school. They are to use their learning and skills from previous activities that have allowed them to identify functions and to look at potential design strategies.

*You are going to use your **skills of enquiry** and you will really start now to **depend on your partner** for generating some great thinking together.*

This could be an everyday problem we have in school, like pupils slipping in the corridor and hurting themselves when it's wet. There are so many human challenges we encounter in our classroom and school buildings.

Let's first use this problem as an example to brainstorm together using the following process:

We first find the verbs and adjectives in the problem to help us explore how nature helps itself and what we can learn from:

- *How does nature stop things from slipping? (e.g. creates rough or bumpy surfaces, creates friction, sticks to itself)*
- *How does nature stop itself getting hurt? (e.g. catching things, protecting from falling)*
- *How does nature keep itself from getting wet? (e.g. absorbing water, removing water)*

In your pairs, can you think of examples in nature that use these functions? Makes notes to share back.

(a gecko's feet stick to surfaces, a spider's web reduces impact, a sea sponge absorbs water, etc.)

Pairs share their answers with the rest of the class and the group notes similarities and different approaches.

Activity 2: Functions that solve the problem (30 minutes)

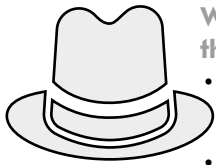
Each pair joins another pair to make a team.

Give each group an organism to **explore**, and **ask them to brainstorm together** the biological strategies of the organism that could serve to solve human challenges. They should then choose and draw the biological strategy that can potentially solve their problem, and annotate the different traits. You could use [Appendix D](#) for this.

For example, a spider (organism) – they draw a spider web with insects caught in it (biological strategy) and annotate the drawing with descriptors (traits); thin invisible strings, sticky, interlocking pattern, lightweight, strong etc.

Team working is a core skill in collaboration as you work together on a common goal. It's sometimes really effective to take on different roles in your team to get the best results and the best thinking. We are going to use a technique called 'Thinking Hats' for this next task. Each Thinking Hat is a different questioning technique to unpick a problem and to help find a solution.

Nominate or let each pupil choose one of the following Thinking Hats in their team. Together they will discuss the traits of their chosen biological strategy and identify which traits will be useful for their design gadget.



White Hat: this seeks the facts and the information that we know.

- *What is the function of the biological strategy?*
- *How does the biological strategy work?*



Yellow Hat: this looks for the positives and the benefits.

- *Why is the biological strategy good at doing its function?*
- *How can the biological strategy help solve our problem?*
- *What are the benefits of using this biological strategy to solve our problem?*



Black Hat: this represents feelings, likes and dislikes.

- *What do we like and dislike about the biological strategy?*
- *What would the biological strategy feel like if we could touch it?*



Orange Hat: this looks for pitfalls and problems.

- *Can you identify any traits that don't help solve our problem?*
- *What challenges do we face using this biological strategy to design our gadget?*
- *How can we improve/change these traits so that it can solve our problem better?*

(More hats can be introduced in further activities e.g. New Ideas Hat and Overseeing Hat)

Teams now discuss and try to solve how nature could help one of the following problems, each framing their statements and questions dependent on their Thinking Hat.

- Our classrooms get really hot in summer.
- The toilets in school always smell really bad.
- There is not enough space in the classroom to put our belongings.

By the end of this activity, each team should have a clear idea of what function from nature they are going to use to solve their problem.

- *What did you figure out?*
- *What part of this process was challenging?*
- *What did you like/dislike about working collaboratively?*
- *Did using the Thinking Hats help you to work together?*



Activity 3: Design a gadget (20 minutes)

As a team of four, pupils will now work together to adapt the function of an organism to create their own original design strategy, using an annotated drawing of an organism's function as inspiration.

- *What everyday problem or human challenge are you going to look to solve?*
- *What materials can you use in your design strategy?*
- *What size is your design going to be?*
- *What materials will you need to make a model of your design?*
- *What's the name of your design going to be?*



Plenary and self-reflection (10 minutes)

- *What challenges do you sometimes come across when working in a team?*
- *What does working with others allow you to do?*
- *How did putting on different 'hats' in the group help (or not help)?*
- *How are you going to work together?*
- *What creative solutions will you find to make this work as a project that you need to collaborate on outside of school?*
- *How will you collaborate to present back to the class?*

Extension

Dependent on time and resource, this activity could be completed as collaborative homework to present design ideas back in the next lesson or could be developed into building a prototype of their gadget.

They could design, give peer assessment and test which one works best over a series of lessons in the term.

Video CPD

For some additional tips and guidance on how to deliver the activities in Lesson 2, check out this [quick six minute CPD video](#). In the video, resource author Seyi Adelekun will talk you through each of the activities and share some ideas for the classroom.

LESSON 3

Presentation and peer feedback

Duration

1 hour (or longer depending on number of groups to present)

Resources

- Visual bank of feedback phrases (see below)
- Pens
- Mini-whiteboards or paper for note-taking

Teams will present and learn skills in peer assessing each other's work. From simple scaffolds you give them, they will see the value in quality feedback they can give each other as collaborators to be able to assess their own work.

Warm up and introduction (15 minutes)

Congratulate the class on **collaborating** in their teams and coming so far on a shared result. This lesson will focus entirely on their presentation of work and the skills and significance of **peer assessment** and feedback.

Each group is going to present their idea (and prototype) to the class, covering the following points:

- The problem they decided upon and the organism they selected.
- The name of their design.
- A presentation of the design strategy.
- Their individual roles in the team.

Give each group time for to prepare and practice their presentations. Encourage groups to keep their presentation to less than 3 minutes long.

Main activity: Giving and receiving feedback (35 minutes)

Each team should present their work, followed by brief class feedback and discussion about their ideas.

*In getting into the habits of creative thinkers, we have contributed to the ideas of others and we can now also get into the habit of **giving and receiving helpful feedback** for each other.*

- *Our feedback will show we have really listened.*
- *Our feedback will show we are curious about each other's work and progress.*
- *What we say will be kind, helpful and specific.*
- *We will critique the work but not the individual pupil.*

Display a bank of the following phrase starters for pupils to focus on in their feedback:

- *What inspired you to use this organism?*
- *The best part for me was...*
- *I like this part, but have you thought of... / how about this...?*
- *I liked this and this but wasn't so sure about this...*
- *Is there a bit that you are less happy with or feel could have gone better?*
- *Which bit was the trickiest?*
- *Which bit do you love the most about your design?*
- *I think that next time you could...*



You might want to recommend a scoring system and suggest students take notes during presentations.

Plenary and self-reflection (10 minutes)

You have worked so well together – I have seen so many improvements in your techniques; but what about you?



- *What was beneficial about working with a shared purpose?*
- *What was challenging about working collaboratively?*
- *How could we improve these issues if we were to do this again?*

With this being the last in the learning sequence, revisit the objectives and compare outcomes:



- *I can understand what biomimicry is and how it is used in technology to inspire ideas.*
- *I can connect biomimicry concepts to my observation of plants and animals.*
- *I have explored how design solutions can be learned from nature.*
- *I have worked collaboratively to find nature's solutions to a human challenge.*
- *I have grown in confidence in thinking critically and being able to give and receive feedback.*

Seyi Adelekun is a multidisciplinary artist, maker and architectural designer based in London. Her practice encourages people to learn about themselves and the world around them through social and environmentally sustainable design. Focusing on community-led spaces that prompt a healthier relationship with nature and the built environment, she has created a diverse range of projects including her installation Plastic Pavilion showcasing at the London Design Festival special event, focusing on design solutions to the climate emergency, and family workshops for the RIBA Festival of Learning Climate Emergency Day.

This resource is delivered as part of Reset – our programme of support in response to the pandemic.

Though COVID-19 has caused huge disruption to our lives, our professions, and our learning, it is important to remember that we are resilient, strong and good at what we do.

We know that we can adapt and work differently, move quickly and innovate. Let's take this chance to reset and move forward with what we know works, leave behind what doesn't, and introduce new ways of working, together.

To find out more, go to:

www.anewdirection.org.uk/reset

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