

EBRAINS 2.0

D1.6 Co-Design Strategy for WP1

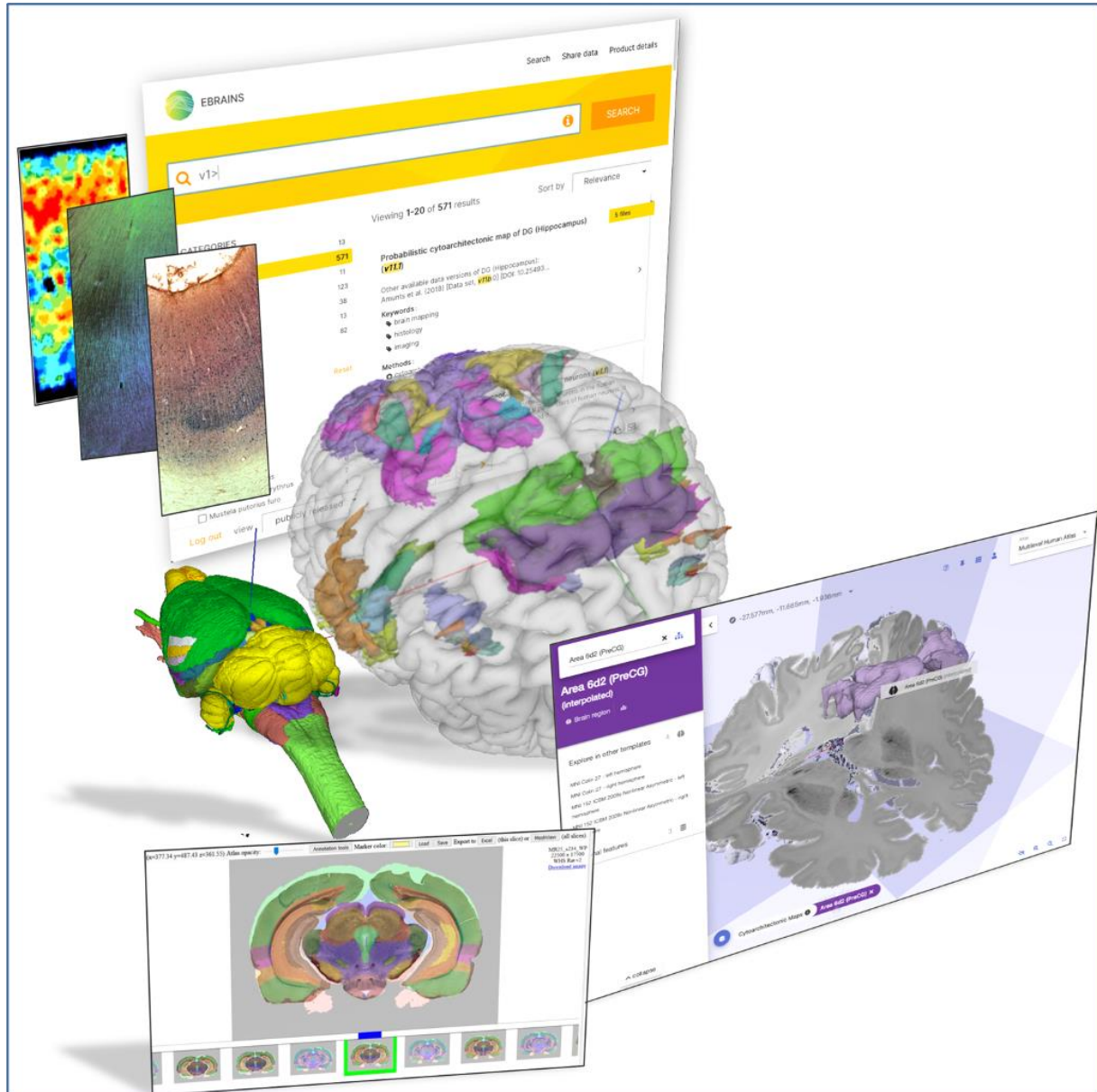


Figure 1: Illustration of EBRAINS atlas services

EBRAINS atlas services in EBRAINS include user applications, software libraries and backend services, which enable users to interact with a broad range of contents, including parcellations of brain regions and multimodal foundational atlas data. The services target neuroscientists in different fields of science but are also designed to comply with needs of developers of other neuroinformatics solutions and infrastructure providers.

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Abstract:	EBRAINS atlas services include installable and web-hosted user applications, software libraries and backend services. which enable users to interact with a broad range of contents, including anatomical reference templates, parcellations of brain regions, and multimodal foundational atlas data. The services target neuroscientists in different fields of research and are also designed to comply with the needs of developers of other neuroinformatics solutions that integrate EBRAINS atlases, providers of the underlying infrastructure services, and requirements brought in by providers of relevant content. To ensure that the development of atlas services is well aligned with the needs of these stakeholders, WP1 identified a range of activities to interact with them throughout the project. The present document outlines these activities, distinguishing interactions inside the work package, interactions with the overall project, and interactions with external stakeholders.		

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1. List of Abbreviations and Acronyms used

Abbreviation/ Acronym	Meaning
WP	Work Package
HPC	High Performance Computing
MS	Milestone
Siibra-python	A Python library for using EBRAINS brain atlases in scripts, notebooks and computational workflows for reproducible analysis and modeling. ¹

2. Introduction

EBRAINS is a dynamic research infrastructure, aiming to address and adapt to the emerging needs of the neuroscience community and brain research at large. To achieve this, a comprehensive model of the different and complementary pathways by which EBRAINS software and services can be built upon and extended by its user community at large is inherent in its architectural design.

This deliverable presents the strategy the EBRAINS 2.0 partners will follow to perform co-design activities within their respective work packages, across the entire project as well as with other project partners and external stakeholders.

Definition of Co-Design:

Co-Design is an iterative process to collect the requirements and expectations from different stakeholders and integrate them into the *design and implementation of a tool, service or platform with the objective of maximizing its adoption, usability, reliability, transparency and impact*. Stakeholders could be project-internal users, partners from other WPs, external users, communities, indirect beneficiaries, external institutions, society, policy makers etc.

The planning of the co-design deliverables (D1.6, D2.5, D3.6, D4.4, D5.5 and D6.5) was developed in close coordination between the work packages, and the template for the reporting was developed jointly over several iterations.

EBRAINS atlas services² provide detailed, multimodal maps of brain regions based on integrated data describing brain structure, function, and connectivity. These atlases offer a common reference framework for locating findings by locations and ontologies (Fig. 1). Compared to other atlases, EBRAINS excels in integrating brain organisation from micro to macro-scales, linking features to their original microscopic measurements, and providing comprehensive information about brain content and intersubject variability. The atlases combine cortical and subcortical maps with detailed measurements of cell distributions, fibre orientations, and molecular properties from post-mortem studies, alongside in vivo maps of function, physiology, metabolism, and connectivity. This integration aids in understanding the healthy brain, studying brain disorders, and developing new treatments. The development of these atlases requires extensive metadata modelling, data standardisation, and continuous integration of new datasets, for which EBRAINS is an excellent platform. WP1 builds and extends on fundamental tools to make atlas accessible for scientific use and enable integration of data and models with atlases. It aims at optimising software solutions for large user groups, integrating atlas services into computational workflows, enhancing compatibility with community tools, and ensuring a scalable infrastructure to support its growing user community. For these activities, efficient interaction and co-design with the relevant stakeholders is essential.

¹ <https://www.ebrains.eu/tools/siibra-python>

² <https://www.ebrains.eu/brain-atlases/reference-atlases/>

3. Co-Design Roadmap

This deliverable provides an overview of co-design actions aimed at achieving key goals of WP1 in the domain of designing and implementing tools, services, or platforms to maximise adoption, usability, reliability, transparency, and impact. WP1 co-design actions are partially specific to WP1, but mainly integrated into actions across the whole EBRAINS 2.0 project. All actions are regularly monitored, and if necessary, updated along the project.

The co-design actions can be categorised along the involved stakeholders:

- amongst contributors of WP1 tasks (Table 1)
- between WP1 contributors and contributors from tasks of other EBRAINS 2.0 WPs (Table 2 and Table 3)
- between WP1 contributors with contributors from external projects (Table 4)

The identification of the co-design actions was guided by the following questions:

- What are the needs and requirements of the users of WP1-relevant tools/services/platforms?
- How can information about user needs and requirements effectively be collected?
- How can success in terms of adoption, usability, reliability, transparency, and impact of WP1-relevant tools/services/platforms be measured?
- How can the consortium effectively deliver co-design actions?

3.1 Co-Design Activities within WP1

Within WP1, it is important that the development of user applications (T1.1) and processing workflows (T1.2) build on well-structured backend services and programming libraries (T1.4, T1.5), as well as on a well-prepared basis of foundational data (T1.3). Therefore, co-design activities in the work package focus on an early and frequent exchange regarding software architecture and data integration activities. These will initially be based on architecture diagrams, user interface mockups and data curation requests, which are further developed into actual software documentation and published datasets. Later during the project, a regular exchange of developers on the one side, and data providers with curation teams on the other side needs to be ensured. Table 1 shows the identified actions needed to organise the co-design activities internally of WP1.

Table 1: Overview of Actions for co-design activities with WP1-internal stakeholders

Goal	Action	Responsible for Action (Task, WP or Person)	Timeline (Project Month)	Indicators
Create an environment for regular exchange between solution and backend/library developers	Set-up a Gitlab group for WP1, including projects for organising the data integration roadmap and developing the software architecture of backend services.	T1.7	M5	Gitlab projects setup; WP1 contributors onboarded to the project
	Establish a regular bi-weekly developer meeting with agile agenda planning	T1.7	M6	Meeting schedule in operation. Agenda for the meeting accessible in the GitLab project.
Establish common understanding of software architecture and interactions between backend services and user interface development	Develop architecture diagrams and basic usage descriptions for essential backend services	T1.4	M5	MS1.5
	Create and discuss user interface drafts of the lighthouse solutions	T1.1	M7	MS1.2
	Organise physical meetings for co-development at least once a year	T1.7	~M8, M12, M18	
Roadmap for integration of foundational datasets	Collect status and form of foundational datasets, and develop a detailed integration roadmap in the form of well documented GitLab issues	T1.3	M6	MS1.4
Assess usability of user applications	Perform internal usability assessments of frontend tools in labs of WP1 contributors	T1.1	~M10, M15, M20	Collection of internal user feedback on different atlas applications available in GitLab

3.2 Co-design activities with project-internal stakeholders

WP1's co-design activities with other work packages focus on three essential aspects:

1. Harmonisation of strategic data categories and establishment of well supported standards for these.
2. Compatibility of software libraries and backends to enable broad and tight integration with the platform.
3. Deployment of atlas services on the different platform elements, especially HPC clusters, virtual machines and protected environments.

These necessitate close interactions with most of the other WPs. Data categories need to be mostly coordinated with WP4 and WP2 and need to reflect the foundation data in T1.3. Software compatibility requires coordination with WP2, WP3 and WP4, and needs to pay special attention to the workflow building established in WP4. The operation and deployment of atlas services requires regular exchange with WP5 and WP6 regarding packaging, documentation and versioning of software. Table 2 shows the identified actions needed to organize the co-design activities internally of EBRAINS 2.0 project.

Table 2: Overview of Actions for co-design activities with project-internal stakeholders

Goal	Action	Responsible for Action (Task, WP or Person)	Timeline (Project Month)	Indicators	Co-Design Partner / Stakeholder
Identify software and data required to connect the WPs	Install communication channels	Task leaders/lead developers	M10		all
	Make agreements on format, anatomical localisation, and brain coverage of foundational atlas data	T1.3	M12	Information integrated in T1.3's data integration roadmap	WP4, WP2
	Identify software and service	Task leaders/lead developers	M10	Roadmap provided to Technical Coordination	WP6
Ensure that the new pentamodal data can be analysed with EBRAINS atlases	Co-develop a toolbox for atlas-driven analysis of the pentamodal datasets	T1.1	M20	M1.3	WP2
Align foundational atlas datasets with strategic data categories identified in WP4	Ensure regular participation of a WP1 member in meetings of T4.5	T1.7	Bi-monthly		WP4
	Issue curation requests for foundational atlas datasets well ahead of their integration to identify curation experts from WP4	T1.3	Continuous activity	Curators linked to foundation datasets in T1.3's integration roadmap	WP4
Ensure integration of atlas services in modeling workflows	Support WP3 developers in integrating siibra-python with their modeling workflows	T1.5	Continuous activity		WP3
	Organise developer meetings for siibra-python users	T1.5	Approximately M10, M16, M22	Regular updates of gitlab issues assigned to the meeting agenda	WP3 WP5
Enable platform architects to operate atlas services efficiently	Ensure appropriate admin documentation of backend services	T1.4	M18, then continuous updates	Admin documentation accessible to WP6	WP6
	Establish monthly meetings with WP6 representatives	T1.7	monthly		WP6
Ensure consistent user involvement	Co-develop the strategies on end users' involvement (education and training, community engagement)	T1.7	Continuous activity	Strategy documents maintained in Tasks 7.1 and 7.2	WP7

The workflows in EBRAINS 2.0 are automated, semi-automated, or more manual in nature and are closely integrated with the tools and services of the science, platform and base infrastructure services. Four showcases have been identified and described in the grant agreement (Table 3). More comprehensive descriptions can be found in D6.5. Co-design actions related to showcases are supported and coordinated by T6.5.

Table 3: Overview of showcases identified in EBRAINS 2.0 to which WP1 contributes

Showcase	WP1 involvement
Atlas-driven analysis of multimodal feature maps	WP1 develops the corresponding user application, siibra-python as the interface layer to atlases, and the relevant backend services to access data features.
QUINT workflow for the analysis of rodent microscopy data	WP1 develops the online workflow.
Personalised multi-scale brain models for the creation of digital twins in clinical applications	WP1 contributes the siibra-python library and supports developers in integrating it. Through the library, models are informed by brain anatomy and multimodal measures of brain organisation.

3.3 Co-design activities with project-external stakeholders

External stakeholders for WP1 come from heterogenous user communities. They include experimentalists, clinicians, modelers, developers of neuroimaging pipelines, academics using atlases for teaching, and researchers in brain-inspired AI. Co-design activities focus on identifying relevant stakeholders and establishing feedback cycles with them, typically in the form of demonstrating EBRAINS atlas use cases at public events and organising tutorials. Table 4 exhibits the actions identified to ensure co-design activities with external stakeholders.

Table 4: Overview of Actions for co-design activities with project-external stakeholders

Goal	Action	Responsible for Action	Timeline	Indicators	Co-Design Partner Stakeholder
Identify external stakeholders	Create a list of representative external stakeholders	WP manager	M12	Representative stakeholder identified in WP-internal document	WP6, WP7 (T.7.2, T7.3, T7.4, T7.7)
	Invite stakeholders to test alpha versions of lighthouse solutions; provide user questionnaire	WP manager	M24	Questionnaires filled for each lighthouse solution	
	Demonstrate use of atlases for education by participating in atlas schools	WP manager	Annually	Participation of WP1 PIs in relevant events	WP7 (T7.1)
	Invite registered users to an atlas group on the Community News channel, and use the group to invite them for co-design activities	WP1.7	M9-M36	Number of registered users on news channel group	
Establish sufficient information resources for	Release video tutorials of key functionalities offered by lighthouse solutions	T1.1	M24	Videos advertised on EBRAINS web page	WP7 (T7.1)

external stakeholders	Publish programming tutorials for siibra python	T1.5	continuously	Availability of tutorials on github	
Promote community contributions	Organise and support open call for integrating spatial omics data with EBRAINS atlas services	T1.6	M1 – M20		WP7 (T7.5)
Transfer knowledge within national nodes, facility hubs	Support national nodes and facility hubs concerning atlasing	Task leaders	Continuous activity		WP4, WP7 (T7.3, T7.4)

4. Outlook

The atlas services in EBRAINS cover a broad range of software including user applications, software libraries and backend services, and always need to be assessed together with their actual contents, especially the brain reference parcellations and templates and foundational atlas datasets. Consequently, the stakeholders of WP1 includes neuroscientists from different application fields, developers of other neuroinformatics solutions that integrate EBRAINS atlases, data providers and curators, and infrastructure providers which operate our services and data.

The goal of the planned co-design activities described in this document is to ensure a solid alignment of the developing atlas services with these stakeholders. It represents an early plan for implementing the necessary interactions and needs to be revised as the developments move along. WP- and project internal co-design activities have already been started and are partly implemented in the workplan, but certainly need to be complemented with additional targeted activities such as building task forces for co-designing workflows for specific data types or polishing specific software interfaces. Co-design activities for external stakeholders rely on selecting concrete persons, groups or institutions to execute. Therefore, the early co-design activities focus on identification of representative stakeholders, which we invite for future interactions such as testing pilot releases or building up community use cases. This will result in an update of Table 4.