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DYNAMIC LANDSCAPES

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Characterized by a lower Alpine topography, the Gürbe River runs in a valley between the Bernese Alps and Midlands of Switzerland. The 30 kilometers of this tributary of the Aare River give rise to challenging natural conditions and have consequently been shaped by an exceptionally tumultuous construction history. In the eighteenth century, the river looked completely different. The Great Gürbe Correction around that time enabled settlement and economic development on the lower stream. Despite the channeling of the Gürbe and the construction of 160 check dams[1] over two centuries, flood damage could not be avoided. On the contrary, the natural hazards in the Gürbe Valley have only increased in the last century. Long-lasting precipitation, in combination with the melting of snow, triggers persistent floods and landslides. Even today, hydraulic protection projects are carried out without lasting effects: the Gürbe River seems untamable.[2]

Of the 65,000 kilometers of watercourses in Switzerland, 14,000 show severe anthropogenic impairment in terms of their structure: they are either blocked, straightened, narrowed, or covered. A strategic revitalization study by the Swiss Federal Office for the Environment has demonstrated that these rivers can directly benefit from revitalization measures in terms of their biodiversity, recreation, safety, and spatial quality.[3] While this study was mainly oriented toward *Renaturierung*,[4] the task is clear: 20 percent of Switzerland's rivers must be redesigned. In the study, ecological objectives were at the forefront, but an integrated and inclusive design approach may provide solutions that go well beyond the primary objectives of this revitalization program.

The performance of a river landscape over time is related to the natural processes acting on it. These vary widely in time and scale, ranging from chemical weathering and sudden hazard events to slow but continuous material transportation in large watershed systems. What they have in common is that they are never stationary but always in motion in dynamic equilibrium. In the case of the unpredictable flows of the Gürbe River, every possible measure is taken to keep the concrete check dams in place. In contrast to the concept of a dynamic equilibrium, these mono-functional concrete structures remain static and are thus vulnerable to hazards. However, we should not forget why these mountain streams were "corrected": to put an end to flooding, provide improved living conditions, and enable increased productivity by drying up the swamps and eliminating diseases like tuberculosis and malaria.

The need for safety, predictability, control, productivity, and health is no less valid today.

How can we engage with the unpredictable rhythms of a dynamic natural force? How can we organize the environment so that it does not constantly disrupt its own performance?[5] I propose dynamic construction as a new method of design and construction as an alternative physical force that operates around sensing, modeling, and fabrication techniques and is capable of responding to changing situations over time. It leverages advances in digital surveying instrumentation and mobile robotic construction equipment that can move large amounts of earth and boulders. These new technologies support a dynamic approach to our environment by integrating information, design, and making to create adaptive, emergent, and open-ended landscapes structures. By monitoring and rearranging materials on site, erosion and sedimentation processes can be redirected seasonally without the need for full control or predictability. In doing so, a dynamic natural system can be maintained over time while addressing ongoing insights and questions of safety and ecology. This novel approach opens the possibility of a new and radically time-sensitive approach, firmly rooted in local geography, materiality, and community. In opposition to creating predefined and static landscapes I advocate earthworks capable of mediating performance between ecological and urban landscapes in an ever-changing environment.[6]

The scope of current renaturation projects in Switzerland seems to be more limited than the hydro-technical river corrections demonstrated over the last two centuries. Large-scale engineering works in natural systems were combined with political will and social relevance to fundamentally re-organize the environment.[7] Let us not wait for the next "natural" disaster to happen. Climate adaptation will necessarily transform our environment, but future landscape designers should be the driving force behind it. The dynamic technologies of the twenty-first century can guide and direct natural processes instead of controlling them, achieving a new dynamic equilibrium between the many protagonists in a landscape. We do not have to tame our rivers after all; we can instead direct their forces in support of our people as well as our planet.

Design process of rapid mass movement studies over dynamic earthworks in the transitional zone of the Gürbe River, Robotic Landscapes III Design Studio, project by Caspar Trueb and Lorin Wiedemeier

1 A check dam is designed to retain solids and reduce the flow rate in the upper and middle reaches of a river. As a result, erosion processes are kept to a minimum by preventing downhill waters from digging into the terrain.

2 Melanie Salvisberg, *Die unzähmbare Gürbe: Überschwemmungen und Hochwasserschutz seit dem 19. Jahrhundert* (Basel: Schwabe, 2017).

3 "Kantonale strategische Planungen," Plattform Renaturierung, https://plattform-renaturierung.ch/revitalisierung/revitalisierung/kantonale-strategische-planungen/ (accessed September 12, 2022).

4 The German word *Renaturierung* designates the active restoration of a state that is as natural as possible, often used in relation to previously channeled river streams.

5 Christopher Alexander, *Notes on the Synthesis of Form* (Cambridge, MA: Harvard University Press, 1964).

6 Ilmar Hurkxkens, "Robotic Landscapes: Topological Approaches to Terrain, Design, and Fabrication." DSc. diss., ETH Zurich, 2020. https://doi.org/10.3929/ETHZ-B-000451100.

7 Hurkxkens, "Robotic Landscapes."