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Gamification of Participatory Science and Digital Transition in Mountain Areas: The Case of the Mercantour Bearded Vulture Network

Alain Schoeny

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Introduction

- 2 Participatory science offers an alternative to certain mountain practices (Mao and Bourlon, 2011) such as hiking and skiing. At the local level, it is based on collaboration between scientists and citizens concerned by ecological and environmental issues (Charvolin, 2019). Often initiated by researchers and run by scientific mediators, the proposed activities to citizens are sometimes associated with recreational practices with a scientific dimension: walking and observation records, etc. (Schoeny, 2022a). These science enthusiasts pass on information to researchers on a voluntary basis, and in so doing contribute, among other things, to the protection of flora and fauna (Schoeny, 2022b). However, this type of data collection is sometimes criticised, and the practices (level of observation, job substitution, etc.) and uses (tedious accompaniment, disclosure of sensitive areas, etc.) associated with it can be considered as counterproductive for research, in terms of the expected benefits (nature conservation, etc.) (Breton, 2022).
- 3 In France, the Mercantour National Park (the Park), internationally recognised as an exceptional area, is an interesting case for study (Stake, 1995). Located in the Provence-Alpes-Côte d'Azur region, it has, since 1993, been the setting for a programme of the

reintroduction of bearded vultures (*Gypaetus barbatus*), Europe's largest bird of prey, which disappeared from the Alps in the early 20th century (photo 1).

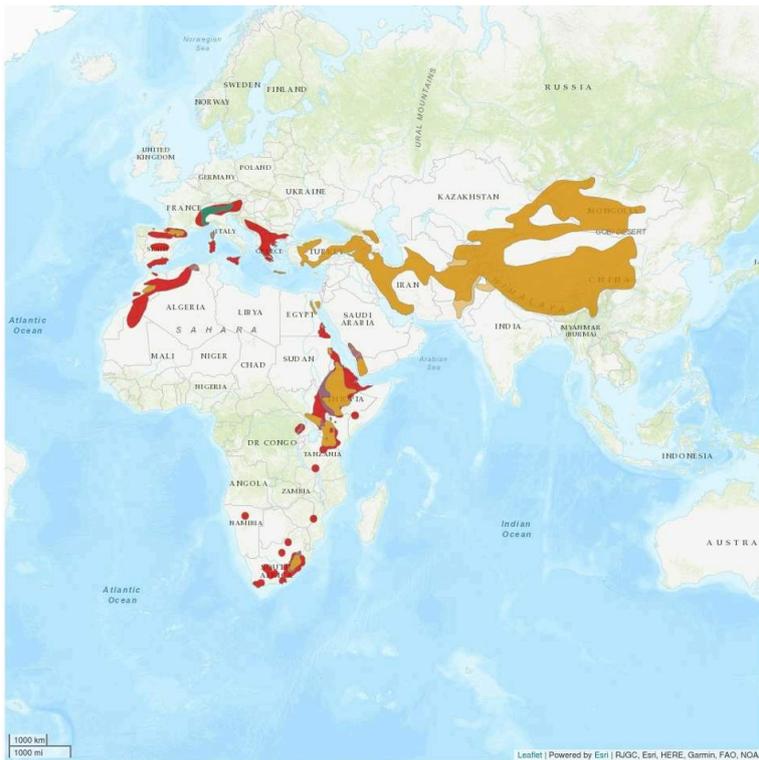
Photo 1: Adult bearded vulture in flight over the Vallon de Demandols



Photo: G. Autran, 2023.

- 4 Following a number of actions to reinforce the programme's base, the Park's management recently promoted the emergence of the "Mercantour Bearded Vulture, Observe, Participate" (Network), which today tends towards participatory science (Breton, op. cit.). This network operates in the form of an intermingling of citizens and environmental technicians from the Park and other neighbouring areas—all volunteers—and continuously expanding thanks to a digital recording system fed by their observations and geolocated movements and through which the reemergence of this "bone breaker"—one of the four species of vulture present in Europe: Crete, Corsica, the Pyrenees and the Alps (map 1)—is monitored.

Map 1: Global habitat distribution of bearded vultures



Adapted: Schoeny (map data: <https://www.iucnredlist.org>).

- 5 From the outset, the Network has organised itself using various digital tools: computers, smartphones, on-board communication architectures, etc., through which the monitoring of bearded vultures is digitalised. This combination of tools has quickly led to “‘peripheral’ ludic activities (...) of ‘ludicisation’—defined as a set of ‘processes that consist in bringing an object into the world of play’” (Barnabé, 2014, citing Genvo [2011]: 2)—which promote the sharing of information about bearded vultures: the fun associated with exploring nesting trails, the emotion that comes with writing a comment about an observation, the pleasure of taking a picture, the feeling of belonging to a community, the desire to learn, etc.
- 6 These digitised observation activities have led to a “gamification through the use of game design elements in non-game contexts” (Deterding et al. 2014: 18) of participatory science; this gamification is based in particular on recreational activities (GPS-guided hikes; species identification using on-board applications; etc.) thanks to the transfer of game mechanisms: rules, means of action, spatial-temporal organisation, etc. (Schoeny and Chaboche, 2022). This process, which takes the form of digitised practices, tends to “improve skills, experience, engagement, effectiveness and productivity outside the pure entertainment area” (Uskov and Sekar, 2014: 619). Digital technology promotes this transition, which is taking place as part of a gradual action approach to raising awareness to positive outcomes in terms of sustainable development (Kuntz et al., 2012). They open up new possibilities, as did the Park’s “Hike, Observe, Participate” programme for the summers of 2018 to 2021—a recreational and fun incentive—which drew the attention of hikers in refuges (photo 2) and hiking clubs to the preservation of the species (Schoeny, 2022b). In this case, as in the present one, the “observe, participate!” strategy—programmatic incentive—is

based on digital interactions that reinforce the observation system and transform participants' perception of the mountain area.

Photo 2: "Hike, observe, participate" event



Photo: www.homme-feuille.fr, Streichertg, 2018.

- 7 Nevertheless, these activities are not without problems, particularly in relation to training observers, validating the data collected, mediating flows, producing, and disseminating information (Irwin, 2018), and even in terms of the volunteers' interpretation of the mission. But how do the practices of the Network's observers tend towards participatory science? How is the digital transition contributing to the gamification of the monitoring of bearded vultures? Does this process promote the development of the bearded vulture population in the Park and facilitate the management of this heritage?
- 8 To answer this question, a documentary study of official sources (Park; Ministries of Ecological Transition, of Education and Youth, of Higher Education and Research; decrees) and academic sources (literature review), as well as inductive field research based on a survey distributed to all Network members, were carried out. We will present its theoretical and contextual framework in the first section of this article, the methodology used in the second, and the results obtained in the third, in order to discuss the gamification of participatory science based on the case of the Network.

Gamification of Participatory Science and the Network's Digital Transition

- 9 In the last twenty years or so (Silvertown, 2009), numerous joint research and citizen initiatives conducted in France and other parts of the world, have helped to advance knowledge about the environment or ecology: water management, endangered species, etc. (Sauermann and Franzoni, 2015). Promoted by the Law of 22 July 2013 on higher

education and research, this dialogue between science and society is very commonly referred to as “participatory science” (Houllier et al., 2017). It is broadly defined as “forms of scientific knowledge production in which non-academic actors participate on an individual or collective basis, in an active and deliberate manner” (Houllier and Merilhou-Goudard, 2016: 12).

- 10 Participatory science promotes community research (Israel et al., 1998) and action research (Chevalier and Buckles, 2019), without being an end in itself, and is considered to have educational and pedagogical benefits that respond to societal and technological issues (Houllier et al., op. cit.). Hacklay (2015) identifies four levels of citizen participation: data collection; participation in data interpretation; participation in problem definition; collaboration with professional scientists. Participation, which underpins the exchange (Roucaayrol, 2018) between professionals and non-professionals, has yet to be studied using a more comprehensive than explanatory epistemological approach (Houllier et al., op. cit.). Indeed, while it opens up science “to a broader audience, and not just to a minority of learned amateurs” (Mathieu, 2012: 26), “It needs to be better documented [since] the change in representation of the problem posed [has not been] identified in the literature” (id.: 422).
- 11 Whether the aim is to defend ideas or to share knowledge, participatory science reveals a desire for participatory democracy, involving citizens in the political decision-making process, based on “small, classic communication exercises [or] attempts at a real redistribution of power [for their] benefit” (Blondiaux, 2021). As an indication of its desire to transform its relations with users, the Park’s management has seized an opportunity for action that combines protection and conservation with knowledge production, using a variety of digital technologies: website, platforms, computer networks and applications, newsletters, and magazines of information, etc. This digital transition has played a key part in the development of participatory science in the Park, leading to a diversity of additional forms and levels of involvement between citizen participation, ecological commitment and participatory research resulting from their cultural strengths (tab. 1).

Table 1: Additional forms and levels of involvement of Network observers

Form	Observers	Level	Involvement
Citizen Participation:	Science enthusiasts	⇒ Contribute to data collection.	<i>Testimony</i>
Ecological commitment :	Learned individuals	⇒ Experiment with interpreting their own data.	<i>Individual and collective knowledge development</i>
Participatory research:	Local technicians	⇒ Participate in data collection and analyse results	<i>Experimentation, facilitation, and restitution</i>
	Department chiefs	⇒ Lead the organisation project.	<i>Support and arbitration</i>

Adapted from literature: Schoeny.

- 12 There is no denying that, coupled with digitisation, these different levels of involvement offer observers opportunities for interaction and the possibility to contribute to this nature conservation and protection programme (Schade et al., 2017). In the tradition of participatory science—between educational and play-based activities—the digitisation of the Network thus allows for “electronic proximity [and broad participation], creating dynamic bridges” (Roucaïrol, op. cit.: 60) between observers.
- 13 These elements of ludicisation lead the participants to carry out tasks spontaneously, through forms of mediated interaction that belong to the aesthetic and interactive world of play (Marache-Francisco and Brangier, 2015). These gamified interactions are intended to promote an involvement in which emphasis is placed on generating pleasant, even amusing, experiences (Brangier and Valléry, 2021), to be grasped using robust methodological tools to understand its mechanism and actual effectiveness.

A Methodology Based on the Interactional Analysis of the Network Members

- 14 This experimentation, in the constructivist sense of the term—i.e., the construction of knowledge that begins with experience (Mucchielli and Noy, 2005)—organises and manages exchanges that take place in the context of the Network’s digital system. Always configured in the course of a situated action (Béguin and Clot, 2004), closely linked to the productive dimension of the Network’s members, these mechanisms serve to detect observation practices in which subjectivised activities are identified in the course of social, professional and cultural interactions (Paillé and Mucchielli, 2016). Through contact with actors that manipulate and experiment with conceptual and material elements, we seek to identify activities which, beyond transforming modes of observation, participate in forms of entertainment and recreational activities.
- 15 Based on this brief review of the literature, in order to better understand the relations between science and society through the adaptation of a gamified scientific approach, a survey targeted by the local technician in charge of the Network (RR) was carried out among the 564 members on their recreational practices and uses of digital tools. 74 people responded online to 29 questions—using Google Forms—with tick box answers (identification), multiple-choice answers (activities), drop-down list answers (uses) and short answers (motivations and needs) and long answers (expectations). With an 11% margin of errorⁱ, several dynamic tables were used to cross-tabulate responses according to the respondent’s qualities (cf. Annexe Table): technician or volunteer, gender, place of residence, level of education, socio-professional categories, date of commitment, motivations, recreational practices, uses of digital tools, knowledge being sought and knowledge acquired, needs and expectations.
- 16 At the same time, computer monitoring was carried out, with the agreement of the RR, to identify iterations on the “Suivi repro Mercantour” Google Group (GG1), made up of 82 very active members, who are also part of a second GG “Gypaète Mercantour” (GG2) whose exclusive task is the dissemination of observation data, of reproduction monitoring and conservation and awareness actions relative to the bearded vulture in the Southern Alps. Over this research period—from 25 January to 04 April 2023 - 99 conversations between members of GG1 relating to the exchange of data on the monitoring of bearded vultures were scrutinised.

- 17 Finally, in order to find out more about members' practices, eight interviews lasting between 18 minutes and 1 hour and 03 minutes (on average 43 minutes, for a total of 5 hours and 46 minutes, most of which were recorded) were conducted and fifteen e-mails were sent. During those exchanges, some members suggested transferring their data to applications that met their needs for monitoring bearded vultures—<https://blog.creamontblanc.org/?p=3874>; <https://domlibs.fr/gypas/valloire.php>; etc.—thereby supplementing our data.
- 18 By giving primacy to the situated nature of their narratives, this methodology has the advantage of identifying the progression of Network members' representations in understanding and producing solutions to the problems encountered. This progression brings to light digital practices among others, based on individual and collective choices that we will analyse once we have described the Network.

An Innovative and Creative Network

- 19 This methodological approach makes it possible to identify a number of innovations through which a de facto grouping was formalised with the creation in March 2016 of the GG1 which comprises friends of the RR, Park's members and other neighbours, in line with GG2 created four months earlier to inform visitors on a regular basis. Moreover, a web application, GeoNature, which can be customised and "ludicised" with badges or scores—"making it easier to use" (according to the designer)—enables others to post their observations (fig. 1). However, as these outsiders have not had to accept the Network's charter of good practice in order to be endorsed by RR, "These options have not been activated in order to maintain the serious nature required for this type of survey".

Figure 1: Free, open-code web solution for everyone

The screenshot shows the 'Obs' Mercantour website interface for the 'Gypaète barbu' program. At the top, there is a navigation bar with 'Accueil', 'Programmes', 'A propos', and 'Se connecter' (Créer votre compte). The main header reads 'LE PROGRAMME GYPAÈTE BARBU'. Below this, there is a large image of a bearded vulture in flight. To the right of the image is a text box with the following content:

Gypaète barbu
Inventaire des gypaètes barbus : randonnez, observez, participez !
 Le casseur-d'os est de retour dans le parc européen Alpi-Maritime Mercantour grâce à un vaste programme de réintroduction ! Plusieurs couples sont désormais installés sur le territoire. L'espèce reste très rare et demeure sujette à de nombreuses menaces (déplacements, persussions, intoxications...)
 Vous pouvez participer au suivi de ce vautour emblématique en transmettant vos observations et vos photographies.
 Vos données sont importantes car elles permettront de mieux connaître l'état de la population sud-alpine dans l'espace transfrontalier, du Mont Viso jusqu'à la Méditerranée : nombre d'oiseaux présents, détection de nouveaux couples en installation.
 Pour en savoir plus sur l'espèce : [Gypaète barbu](#)

Below the text box is a list of observations for 'Gypaète barbu'. The list includes the following entries:

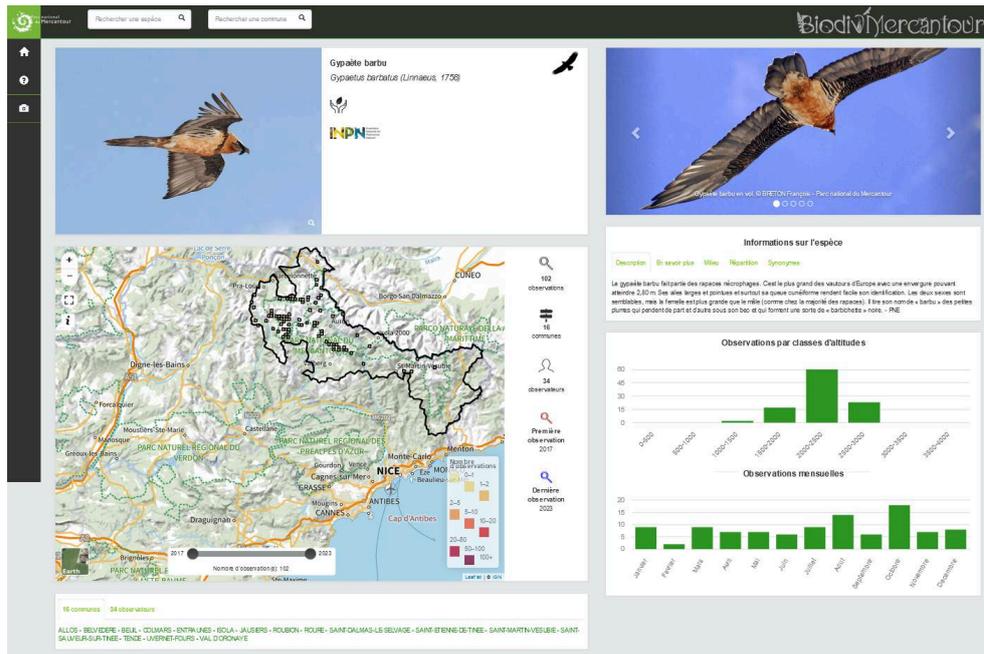
- Gypaète barbu (Stg94) le 2023-10-22 à *Uvernet-Fours*
- Gypaète barbu (Tiam) le 2023-08-15 à *Tende*
- Gypaète barbu (Anonyme) le 2023-08-04 à *Argentera*
- Gypaète barbu (su marionette) le 2023-07-10 à *Argentera*
- Gypaète barbu (clore) le 2023-06-25 à *Breil-sur-Roya*

To the right of the list is a map of the Alpine region, showing cities like Chambéry, Grenoble, Turin, Valence, Orange, Avignon, Aix-en-Provence, Marseille, Toulon, Cannes, Nice, Monaco, San Remo, Gênes, and Milan. The map also shows the 'Golfe de Gênes' and 'MER DE LIGURIE'. At the bottom of the page, there is a footer with logos for 'national Mercantour', 'Accueil | GeoNature-citizen | A propos', 'Action financée par le Fonds Européen de Développement Régional (FEDER) Programme Interreg Alcotra 2014-2020.', and logos for 'interres ALCOTRA' and 'ALPES MONTAGNES'.

Data source: Park.

- 20 Other programmes, such as the Generalised Biological Inventory and the Atlas of Communal Biodiversity, have been drawn from this pioneering digital experimentation. This process of empowerment and enrichment, which is cooperative and collaborative (GG1) as well as entertaining and educational (GG2), involves various derivation processes: duplication and creation, to transmit knowledge (Bertrand and Fouquerey, 2017). It takes shape through collective identification practices based on the collection and sharing of context-related data regarding the territory in which bearded vultures occur (fig. 2).

Figure 2: Open-to-all-bearded vulture inventory



Data source: Park.

- 21 The Network has become a community, shifting from being an insiders' club to one that has adapted and opened up to new people of goodwill, and is now recognised by the Park. This has led one of its members to create a logo that incorporates elements of the Park's visual branding, which now appears in all official publications about bearded vultures (fig. 3).

Figure 3: Recognition of the Network's logo through visual association with the Park's

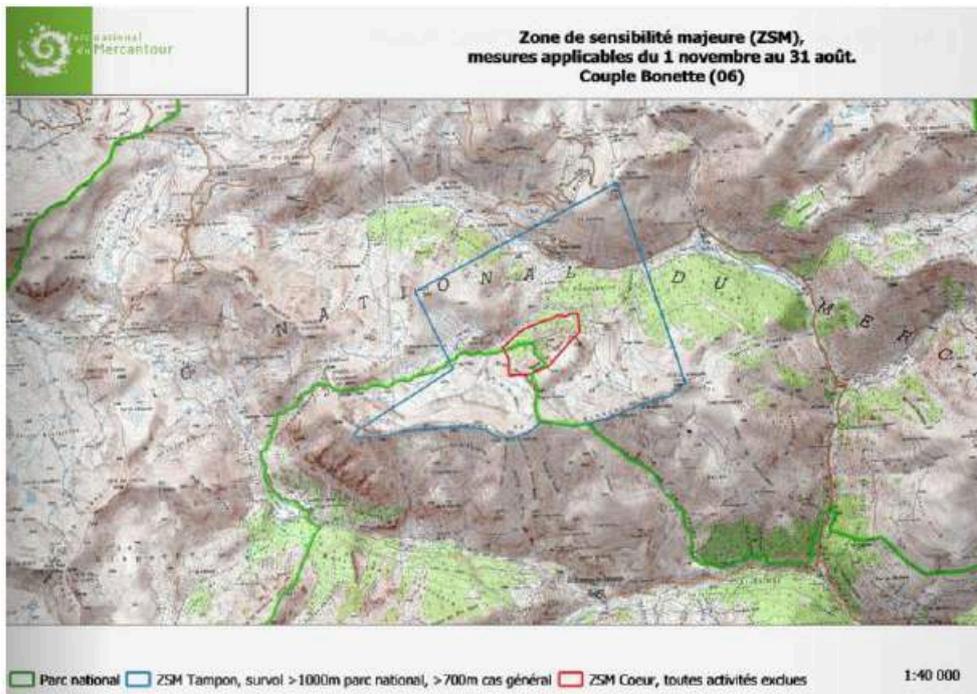


Data source: Park; Park's logo – Network logo (Titre, 2019).

The network is not an association and therefore has no legal status; it is simply an offshoot of the Park. Its logo's design subtly echoes that of the Park through colour and typography, but without making the link between the two too obvious (RR).

- 22 Drawing from “open innovations” (Chesbrough, 2003), and from collaborations with non-park members, the Network's activities are aimed at developing new services between users: drawing up and diffusion of visual materials representing high sensitivity areas (fig. 4) with the aim of protecting bearded vultures from hikers, wildlife photographers and hang gliders; digital alerts via the Network that call on members to go to the site to monitor a bearded vulture regarding which no recent data exists; and so on.

Figure 4: Example of identification of high sensitivity areas (HSA)



Data source: Park.

- 23 Thus, despite the cautious discourse of some of its members —
- “Given the drastic reduction in the number of staff dedicated to protected and unprotected natural areas, it would be a good idea to reconsider participation. Participation is more about relationships than about technology, which is merely a service. And there can be no relationship without people ... people, all at the bedside of life on earth, of our own life” (interview) —
- 24 “the participatory computing tools” (or Web 2.0) that they use contributes to participatory practices centred “on interaction and contribution, [that pave] the way to original forms of participation such as a [great] collection of data [(500 per year (Breton, op. cit.))] and the use of [forms of] gamification” (Houllier et al., op. cit.: 419), which we need to identify by examining their practices.

From Electronic Exchanges to Digital Network Practices

- 25 Electronic exchanges are the hallmark of “open science [which disseminates (...)] research publications and data [by using] the opportunity presented by digital change to develop access to them” (National Plan for Open Science, 2021). The “ludogeneity” of digital practices—i.e., their intrinsic capacity to engender an attitude of play—has been accentuated through the efforts of RR alone (mission statement), and has been integrated into various activities, thus promoting the development of “playsure” experiences (Vial, 2015). With this framework, the digital transition, which contributes to the gamification of the Network, can be better understood by examining the goals and scenarios (Deterding et al, op. cit.) in which semiotic objects (signifying elements) extend the attitude of the members (players) and their monitoring of bearded vultures (play) beyond observations (games) (tab. 2).

Table 2: From digital transition to the gamification of bearded vulture monitoring.

Key dates	Context of use	Purpose	Scenarios
1993 ⇔	Data transmission (telephone and e-mail)	To help	Word of mouth
June 2009	Distribution of electronic information	Service	Newsletter
December 2016	Creation of the “Mercantour Vulture” group (GG2)	To inform	Appointment
Mars 2017	Creation of the “Mercantour repro monitoring” group (GG1)	Traceability	Collaboration
2018- 2021	Hike, Observe, Participate” activities	To communicate	Recreational
2019	Logo design Flocked cap Annual meal	Recognition	Identification
Mai 2019	Creation of the online newsletter.	To communicate	Loyalty
2021 ⇔	Programme: Mercantour Vulture Network, watch and take part!	To cooperate	Engagement

Schoeny: survey, interviews and IT monitoring.

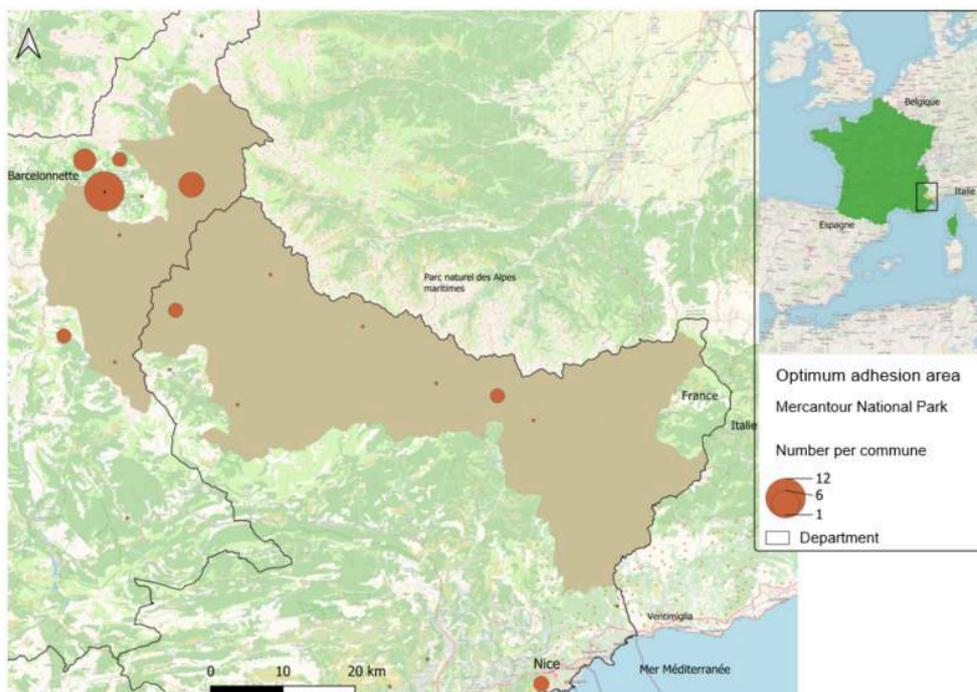
- 26 At the level of the programme of the reintroduction of bearded vultures, the growing influence of digital tools helps to advance scientific knowledge and to reinforce the protection of the species through various information processes (word-of-mouth, newsletters, collaboration, and recreational activities). Digital technology is helping to shift the focus from the individual (e.g., helping) to the collective (e.g., cooperating). Thanks to this participation, the Network enjoys a degree of recognition (logo, cap and an end-of-year function), which stimulates member loyalty and commitment (survey and interviews).
- 27 This digital transition therefore contributes to the gamification of bearded vulture monitoring through the empowerment and enrichment of (Schoeny and Chaboche, *op. cit.*) the Network’s community. More specifically and as part of this transition, we observe play-based conquests of objects: mapping, photography, hiking, etc. and conquests of play objects: application, website, smartphone, etc., which are not initially games (*cf. ludicisation, supra.*). They gradually become part of the mechanisms of acquisition of knowledge about bearded vultures, with each mechanism being unique and likely to go beyond the framework in which it was constructed (experience). The success of this process thus depends on the playability of elements manufactured (Vial, *op. cit.*) by the Network, in particular thanks to the ability of the members to adapt to the digital tools, to their representations and observation practices which are

constantly evolving in view of the “expectations and needs for mutual enrichment and autonomy” (survey and interviews) which we must now examine.

A Social Space Conducive to the Gamification of Bearded Vulture Monitoring

- 28 Although the Network has operated a cultural and organisational shift towards participatory science thanks to digital technology (cf. above), the spatialisation of bearded vulture monitoring remains relatively contained geographically (map 2).

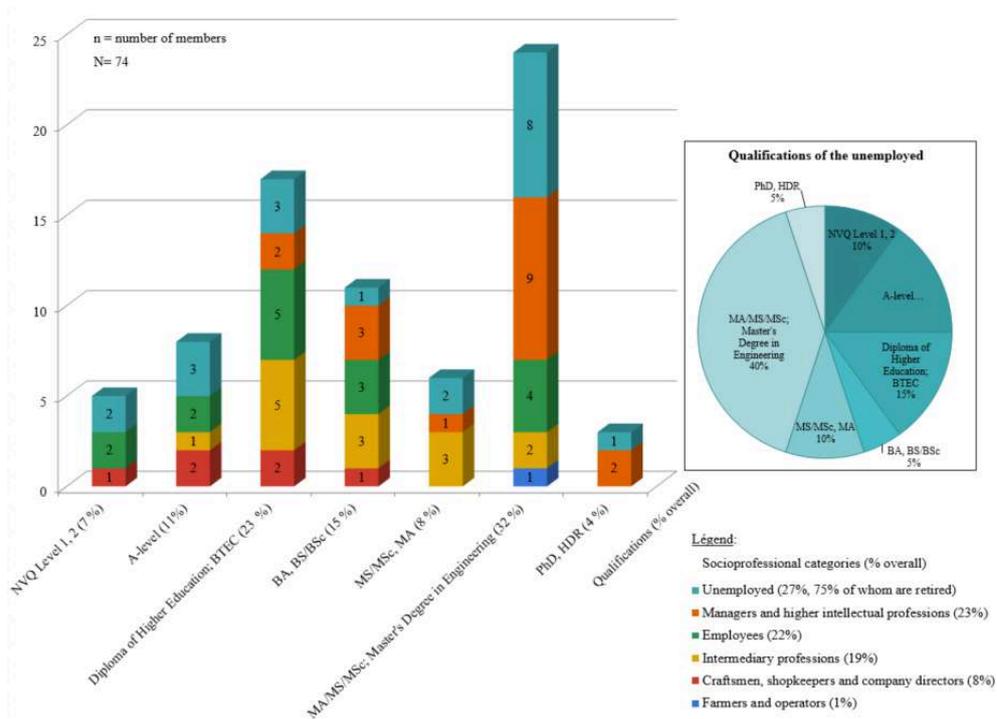
Map 2: Location of Network members in 2023



Production: Nasser, CEDETTE, 2023 (survey data: Schoeny, 2023).

- 29 The spatial distribution of the observers extends from the RR’s workplace in Barcelonnette to the areas in which people with whom he has professional and personal relationships are located, relationships based on a shared desire to preserve and protect the bearded vulture’s environment. In the optimal adhesion area Park, there has been no loss of momentum in the Network’s digital system, with no drop in the intensity of exchanges: 10 new members for GG2 and 101 data collections for GG1 were recorded during this study. The uneven distribution of the diffusion sites — only 40% of members are located within the Park—correspond to the locations where bearded vultures live and to the location of local contacts (technicians and volunteers) who are themselves members of other observation networks (Avifaune, Queyras Regional Park and Ecrins National Park). Thus, while most of the exchanges in the Network are now digital (which refers to the use of digital technologies to disseminate data and which abolishes distance and time, as well as to changes in behaviour), the members’ profiles tend to point to a rather homogeneous (graph 1) social space (Lenoir, 2004) built initially through word of mouth, and subsequently with individuals separated by relatively short social and cultural distances.

Graph 1: A network with a strong social and educational capital



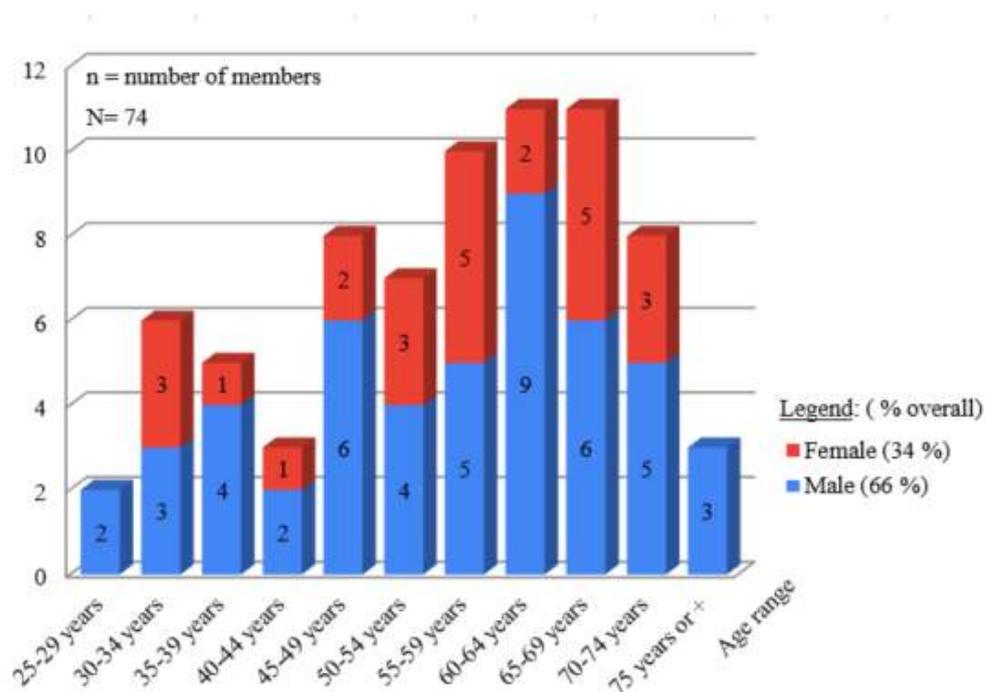
Design and production: Schoeny (survey data).

- 30 As shown in the above graph, the high educational level (82% of members have a higher education degree) and social capital (over 50% are in an “upper” socio-professional category) constitute a factor of proximity which promotes the development of a clan-like group, for which the bearded vulture has become a totem, or even a symbol to be defended:

Maintain maximum confidentiality and protect them from human disturbance, which is increasing in the mountains / Human activities are changing too... and not always in a respectful way / To not disturb them / To leave them in peace (survey).

- 31 The Network comprises mainly men (66%) and people aged between 60 and 69, with an average age of 50 to 54, and is made up of experienced people (graph 2).

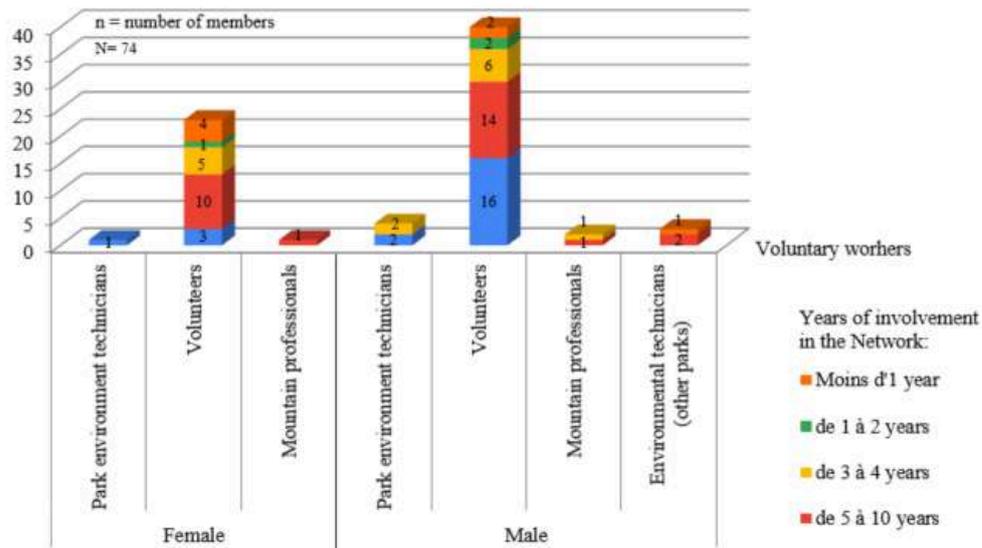
Graph 2: An unbalanced gender and age distribution



Design and production: Schoeny (survey data).

- 32 The time factor is essential for participating in the Network. Members tend to be mature adults (ecological awareness [Matagne, 2003]), in an advanced stage in their careers and family lives (only 34% of members still live with partners and children); most members are aged between 49 and 74, with the largest share aged 55 to 69. There is a notable absence of young women (known to carry a heavier load than men in terms of parenting and domestic responsibilities [Régner-Loilier, 2009]), and of those aged 75 and over (it can be assumed that the dangerousness and virility traditionally associated with mountain activities [Ottogalli-Mazzacavallo, 2004] are obstacles to their involvement). Finally, long-term commitment seems to be a constant among volunteers: more than 86% have been involved for more than three years, over one third of whom have been involved for more than ten years (graph 3).

Graph 3: A high level of loyalty among Network members

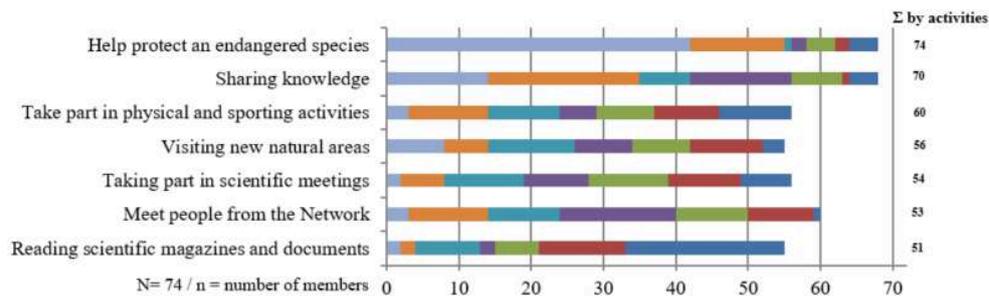


Design and production: Schoeny (survey data).

Representations and Practices of Network Members

- 33 In the collective imagination, between practices and representations (Giust-Desprairies 2009), “Belonging to the Network gives [members] a relative legitimacy in trying to raise awareness among the people they meet” (survey). Three main reasons for their involvement can be identified: a desire for knowledge-sharing, for interactions with other members and, to a lesser extent, for recreational activities (walking, photography, etc.). On the other hand, scientific activities (literature and scientific meetings) are not actually the greatest motivation to get involved (graph 4).

Graph 4: The main activities of Network members



Ranking of favourite activities :	Reading scientific magazines and documents	Meet people from the Network	Taking part in scientific meetings	Visiting new natural areas	Take part in physical and sporting activities	Sharing knowledge	Help protect an endangered species
■ Chosen 1st	2	3	2	8	3	14	42
■ Chosen in 2nd	2	11	6	6	11	21	13
■ Chosen in 3rd	9	10	11	12	10	7	1
■ Chosen in 4th	2	16	9	8	5	14	2
■ Chosen in 5th	6	10	11	8	8	7	4
■ Chosen in 6th	12	9	10	10	9	1	2
■ Chosen in 7th	22	1	7	3	10	4	4

Design and production: Schoeny (survey data).

- 34 Noteworthy is the desire to have power and control over, and even “privatise” the area (cf. HSA, above) for their own benefit.
 ...ban access (...), but I go there as close as possible to them with my customers (survey).
- 35 Another interesting thing to note is the fact that members seek to “get involved in specific activities within the Network” such as:
 Serving as protection officer / Ensuring protection / Reporting situations that constitute a threat to nature (investigation).
- 36 Volunteers exercise a form of administrative policing, since “they are the ones who are in the know” (interview):
 Subject [of e-mail]: carelessness!
 Today [...], a careless deer antler seeker was prospecting in the Vallon’s HSA [...]. A NMP (National Mercantour Park) car was parked [...] but apparently the offender was not seen! [...]. Signs should really be put up to inform people (computer monitoring).
- 37 This transfer of or the possibility to interchange roles (as in the case above, with the function of park ranger) has also been observed in other gamification practices, such as Internet writing activities (Barnabé, op. cit.) or within communities (Flichy, 2010). Gamification and digital technology thus promote forms of participation and skill building that are conducive to the development of equality-based relations between environmental technicians and volunteers. However, although the latter wish to “differentiate themselves from naturalists”, of whom they are rather critical (survey and interviews), the monitoring of bearded vultures does not give rise to any debates about legitimacy, nor to any criticism or value judgements. The personality and track record of the RR undoubtedly contribute to this constructive balance.
- 38 Of the volunteers questioned, 77% were “very satisfied with the digital performance of the Network”, which enabled them to “better understand how bearded vultures live”

(97%) “and the challenges and implications of cohabitation” (96%). In terms of progress, some would like to have data synthesis tools and tools for recognising bearded vultures so that they can go further in their investigations (a website listing bearded vultures with their characteristics: identity, routes, reproduction, sound library, etc. linked to other interfaces such as observation.org for exchanges with volunteer observers of other mountain areas). The respondents’ comments regarding their expectations reflect a “need for sharing” (meetings) and “for fluidity” (interactivity) between members (to “organise joint outings”, for example), but also “with other observation networks”. The idea is to enable as many volunteers as possible to use the digital tools made available, so that they are not reserved for a minority, albeit a very active one. In this way, the Park’s mission—between management and transmission of heritage to future generations—is supported by the gamification of its operations, which tend “towards participatory science”, the experimentation around which is “much appreciated and scrutinised by others” (interviews), and now applies to virtually all its programmes.

Conclusion and Discussion

- 39 This study has aimed to document the gamification of participatory science and the digital transition. Using mainly digital tools to monitor bearded vultures, a network of volunteers and environmental technicians have unknowingly (survey and interviews) used gamification mechanisms that are not always due to digital technology through their play-based conquests of objects (maps, etc.) and of play objects (photos, etc.).
- 40 This conception of gamification of participatory science and of the role of digital technology leads us to believe that it reinforces experimentation among volunteers and that it has helped to build volunteer loyalty. In this respect, the use of artefacts contributes to a process of incorporation and learning, with “play” only playing a secondary role (in a similar way to serious games [Goria, 2016] found in many activities [teaching, health, etc.]). Indeed, the members have a ludicisation-based conception of gamification (transfer, transformation, and extension of the activity) rather than a play-based approach (playing), as bearded vultures are a species protected in France by ministerial decree.
- 41 In fact, the appropriation of certain behaviours through the gamification of participatory science constitutes the “player” experience for the volunteers: helping and protecting, an idea at the forefront of the Park’s missions: a Park whose objective is also one of protection and transmission. However, there remain some problems, such as those denounced by a number of environmental technicians and department managers regarding the quality of the data transmitted and the tedious nature of volunteer supervision (not to mention the extraterritorial constraints related to the movements of bearded vultures, which are not confined to the Park). But, as we have shown, we are dealing with an easy-to-capture population: culturally determined and determined to have a clear understanding of ecological, societal and—for some—technological issues and to take action accordingly.
- 42 Nevertheless, we have also noted that few members of the Network are primarily concerned about issues related to the monitoring of bearded vultures, such as that of the cohabitation of humans and vultures or that of education, since “disturbance comes from others” (interviews). Yet, they lack perspective on their impact. This creates

ambiguous relations of power and strength with others. It is therefore very difficult to assess the effectiveness of these fundamental questions, not to mention the fact that there is a lack of productivity in terms of actions to raise awareness among a broad public, with the Network members ultimately remaining what might be called the local elite. This is not conducive to capturing new audiences. It is partly due to the essentialisation of the volunteers' discourse and a form of social schizophrenia (in the sense of an insurmountable duality) perceived during the interviews (distrust of this research) with the volunteers. Isn't one of the aims of the gamification of participatory science to take the drama out of our relationship with the environment by avoiding pathos, denial, or withdrawal, by supporting new approaches to sustainable development shared by as many people as possible? More pragmatically, wouldn't it be useful to consider training in digital resources (along the lines of the very recent training programme for "lifelong qualification and support for territories—as part of the deployment of the Esprit Parc National brand" for its partners), as was often suggested by the respondents? Finally, there is a necessity for all to take up the challenges of digital and environmental transition for mountain areas, a topic which is not on the agenda of the Park's emerging participatory science.

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ABSTRACTS

Participatory science is an alternative to certain mountain practices. At local, it rests on collaborations between scientists and citizens. In France, the Mercantour National Park, a unique territory, is an interesting case for study. Located in the Provence-Alpes-Côte d’Azur region, it has, since 1993, been the setting for a programme of reintroduction of bearded vultures. Thus, the Park, with over 500 volunteers, has organised itself to follow its evolution. Digital technologies play an important part in this, particularly in the collection, transmission and exchange of data, and various game mechanisms contribute to the gamification of bearded vulture monitoring in the Mercantour. This article specifies its outlines so as to help better understand its principles, which have more to do with play-oriented attitudes towards non-recreational objects than with a conquest of recreational objects. A survey, interviews and IT monitoring were thus conducted to explain what can today be described as gamification of participatory science, which the digital transition has activated.

gamification, sciences participatives, transition numérique, ludicisation, Mercantour

Les sciences participatives sont une alternative à certaines pratiques montagnardes. Localement, elles s’appuient sur des collaborations entre scientifiques et citoyens. En France, le Parc national du Mercantour, territoire d’exception, est un cas d’étude intéressant. Situé en Région Provence-Alpes-Côte d’Azur, il est depuis 1993 le cadre d’un programme de réintroduction du gypaète barbu. Aussi, le Parc et plus de 500 volontaires se sont organisés pour suivre son évolution. Le numérique y prend une part importante, notamment pour le recueil, la transmission et l’échange de données. Ce faisant, divers mécanismes de ludicisation participent à la gamification du suivi du gypaète dans le Mercantour. Cet article en précise alors les contours afin de comprendre les principes qui sont plus de l’ordre d’attitudes ludiques envers des objets non-ludiques que des conquêtes d’objets ludiques. Une enquête, des entretiens et une veille informatique ont donc été menés pour expliquer ce que l’on peut aujourd’hui qualifier de gamification des sciences participatives dont la transition numérique en est l’activatrice.

INDEX

Keywords: gamification, participatory science, digital transition, ludicisation, Mercantour

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