

**Rhetorics of Resilience and Extended Crises
Reasoning in the Moral Situation of Our Post-Pandemic World**

Copeland, Samantha; Cañizares-Gaztelu, Jose C.

DOI

[10.1007/978-3-031-08424-9_13](https://doi.org/10.1007/978-3-031-08424-9_13)

Publication date

2022

Document Version

Final published version

Published in

Values for a Post-Pandemic Future

Citation (APA)

Copeland, S., & Cañizares-Gaztelu, J. C. (2022). Rhetorics of Resilience and Extended Crises: Reasoning in the Moral Situation of Our Post-Pandemic World. In *Values for a Post-Pandemic Future* (pp. 233-250). (Philosophy of Engineering and Technology; Vol. 40). Springer Nature. https://doi.org/10.1007/978-3-031-08424-9_13

Important note

To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

Chapter 13

Rhetorics of Resilience and Extended Crises: Reasoning in the Moral Situation of Our Post-Pandemic World



Samantha Copeland and Jose C. Cañizares-Gaztelu

13.1 Introduction

The normative discourses that have arisen around the COVID-19 global pandemic illustrate essential changes in our moral landscape. We argue in this chapter that these changes raise important moral challenges, but that some of these challenges can be at least partly addressed by critically assessing the role of resilience in pandemic discourse.

Since the 1970s in ecology (Holling, 1973), and increasingly in many other scientific disciplines and practical contexts (Brown, 2012; Doorn, 2015; Meerow & Stults, 2016), resilience has been proposed as a principle and approach for managing complex systems in a context of uncertainty. In many of these accounts, resilience is viewed as a descriptive concept that denotes some kind of response of complex systems to shocks and stresses (Brand & Jax, 2007; Elmqvist et al., 2019). However, tropes about resilience also became rather omnipresent during the pandemic, highlighting its complex, unexpected and unpredictable character, and communicating advice and instruction over what we can and should do in such an unusual situation. Because resilience has become an important concept for practical and moral reasoning in and about the pandemic, we look closely at the pitfalls and potential benefits of these normative uses of resilience in pandemic discourse.

We begin by addressing both the situation and the nature of the moral complexity elicited by the pandemic (Sect. 13.2). Next we introduce relevant conceptual aspects of resilience (Sect. 13.3) and illustrate some key and recurrent resilience tropes in the rhetoric around COVID-19 (Sect. 13.4). After taking up normativity theory to highlight and critically assess some problematic normative aspects of

S. Copeland (✉) · J. C. Cañizares-Gaztelu
Delft University of Technology, Delft, Netherlands
e-mail: s.m.copeland@tudelft.nl; j.c.canizaresgaztelu@tudelft.nl

these tropes (Sect. 13.5), we suggest ways to overcome or at least address the conflicts and problems these tropes seem to raise (Sect. 13.6).

13.2 The Moral Situation Presented by the Pandemic

The pandemic presents us with a situation that is particularly riddled with moral complexity. For example, David Shaw (2021) characterizes this situation as one where we experience a lack of motivation to comply with imposed restrictions due to the problem of ‘moral distance’. Shaw argues that the distance between us limits our ability to perceive or to address our moral duties to each other effectively, because we cannot properly assess the probable consequences of our actions. For example, asymptomatic individuals are unlikely to know they have the virus, and so their most rational and considerate assessments may still be incorrect: they may indirectly infect someone despite their best efforts to take precautions. This line of reasoning also clearly echoes the problem of ‘moral luck’,¹ wherein contingencies, rather than intentions or even causal relations, determine the moral evaluation of an action. For example, I may perform the same actions with the same intentions, such as going out to dinner and following the masking and distancing rules as required, and in one case dine without consequences, but in another case contribute to a cascade of infections that results in someone’s death—depending, perhaps, on the weather and the way the wind was blowing that day.

The distance problem and the issue of moral luck illustrate the moral dilemmas that arise when we weigh our actions and choices against both their current and close and their distant and future implications. When taking a ‘multi-scalar’ perspective, apparently simple situations become complex and uncertain; when one cannot know for certain the results of one’s actions, one cannot easily decide which actions will be the best or the ‘right’ thing to do. Here we want to argue that our situation as moral agents in the pandemic is still more complex, but also, not hopeless. Shaw himself proposes a strategy for increasing people’s awareness of consequences that are probable even if unpredictable in this situation, but he focuses only on a limited subset of the problems involved in this multi-scalar moral situation, those that relate to our other-regarding decisions and actions. His solution, to provide more awareness of the probable and possible implications of our actions for others, is consequently insufficient to guide moral reasoning in this complex situation. We think that in the case of this pandemic, this picture needs broadening in at least three significant directions in order to enhance our understanding of the moral challenges at hand.

One relates to the nature of the pandemic *crisis*—a term that is both accurate and telling. The sudden and disruptive pandemic onset could be framed as a shock with

¹Please note this is indeed a shallow review of two problems that philosophers have put considerable thought toward, but a deeper analysis is outside the scope of this chapter.

which we had to cope. But episodes such as the 3-month full lockdown in Spain are more suitably described as imposing ongoing stress upon individuals, households and local systems. In hindsight, rather than as a single stressor or shock, the pandemic as a whole is best characterized as having involved (and as still involving) bundles of stressors and shocks that compound and interact with each other across space and over time. One can learn from shocks and apply those lessons to similar shocks in the future. As illustrated by adaptive preferences (Elster, 1983; Teschl & Comim, 2005), one can also get used to stressors and learn to live with them. But how does one adapt to, and make decisions about, the radically uncertain (Hansson, 1996; Stirling, 2010) –where not only the likelihood of outcomes, but the possible outcomes themselves, and even the intervening factors in the situation, are unknown? In other words: we must accommodate both the many concrete and more or less tractable moral challenges that the pandemic is forcing upon us, and the general context of extended and evolving crisis that the pandemic itself represents.

A second issue is that our self-regarding decisions and actions (the prudential dimension of ethics) are also critical. Granted, we need to protect the health of those we know and, surely, we also have an obligation towards the welfare of those who are distant from us, in space or time. But this duty cannot be neatly separated from the duty to protect our own health by avoiding catching the virus –and then passing it along. Moreover, the pandemic also threw upon us many other economic and social problems with longer term and often more intangible repercussions: we struggle to cope with these problems because they can affect both us and others in a reciprocal fashion. Indeed, through countless media platforms, memes and news, in this pandemic we were bombarded with all kinds of tips for coping with the pandemic, the policy changes and the problems they entail, including the stresses of self-isolation, job loss and increasing duties at work and home (now overlapping for many of us), and even with the growing anxiety about impending global economic collapse. Thus, another key moral fact about the pandemic is that its repercussions are tangible and intangible, near and remote, and that they affect us and then others –and vice versa. These cross-scalar and iterative effects mean not only that we have self-regarding as well as other-regarding duties: in a sense, they mean that the distant other is also us.

Framing the situation in terms of moral distance alone also neglects the transformative potential of the pandemic. As we live through the pandemic, we struggle to cope with the problems we encounter. Yet, as the crisis persists and unfolds in new directions, we also try to create and seize opportunities to enact change that might enable us to respond better both to the pandemic and to similar crises in the future. Indeed, we have sometimes been asked to actively embrace the change forced upon the world for its transformative potential. For example, as Arundhati Roy argued early on, “[t]he pandemic is a portal” (Roy, 2020) –an opportunity to embrace radical change for climate mitigation and adaptation, now that the pandemic has demonstrated our capacity for accepting radical change, and because returning to “normal” is implausible at any rate.

Thus, the dilemmas with moral reasoning at various scales come in many forms in this situation. Can we prioritize ourselves against others, and should we? Is this

travel policy a matter of health, of economic interest, of national identity, or of trust-building? Should it be different, and why? Can I afford sticking to conventions, to the law and scientific advice, or should I be bolder, and when? These dilemmas cannot be understated –in fact, they extend beyond the moral distance issue highlighted by Shaw. Yet, in the next sections our position will be that lessons from resilience thinking can capture many of these moral dilemmas while also offering a guide for ethical deliberation and thought –in the context of the pandemic and beyond. To this end, we turn now to resilience research to briefly explain what this concept is about and some of the tensions and problems involved in its use.

13.3 The Nature of Resilience

Having its origins in the mechanical sciences, resilience is now used in multiple ways in many disciplines (Alexander, 2013), and is consequently both a complex and ambiguous concept overall (Brand & Jax, 2007; Strunz, 2012; Woods, 2015). Despite this variety of uses, however, classical accounts of resilience coincide in several ways. First, they generally present resilience as manifesting in conditions where uncertainty reigns: more particularly, as the ability to respond well and survive through unpredictable or unforeseeable shocks or stressors (Holling, 1973, 1978; Norris et al., 2008). Second, resilience is applied at various scales: in psychology, for example, it is the individual propensity or demonstrated capacity to withstand crises or shocks (Southwick et al., 2014); in ecology and related sciences, it denotes a similar capability, but of complex ecological systems, from the local (Hughes et al., 2005) to the global (Rockström et al., 2009). A third widely noted feature of resilience is the complicated interplay between conservation and change it denotes (Carpenter & Brock, 2008), since resilient individuals or systems are those that ‘bounce back’ from a crisis, but also adapt effectively to new circumstances while retaining primary functions. For example, people are resilient insofar as they maintain (primarily physical and psychological) health despite encountering great adversity (Southwick et al., 2014), and/or if they adapt well to novel and unexpected conditions (Norris et al., 2008); and ecological and other complex systems are resilient when they “absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al., 2004). In general, then, in the context of a shock or stress, resilient systems respond by preserving their identity (or their critical features) while also leaving behind the non-essential, or adapting somehow to the new situation.

Although traditional approaches to resilience are still very influential (Elmqvist et al., 2019), resilience thinking has undergone an important evolution in the last two decades. One such development concerns a social turn in resilience thinking (Brand & Jax, 2007). At least since the mid-1990s, the ecological perspective on resilience has been proclaimed applicable to any complex system (Holling, 1996), which prompted efforts to understand and address the resilience of socio-ecological systems (Gunderson & Holling, 2002), engineering and socio-technical systems

(Hollnagel et al., 2006; Wardekker et al., 2010) and other systems of systems, including cities (Meerow et al., 2016). Today, resilience is widely applied in contexts such as urban planning or development studies, often by combining complex systems insights about natural systems, infrastructure, society and institutions into comprehensive strategies related to the management of risks.

This social turn has also raised the growing need to reconcile the system-of-systems perspective of resilience, coming from ecology, with the inclusion of people in this picture. Consider the example of cities. While cities can be framed as systems-of-systems or networks-of-networks, such perspectives might ignore individuals, and even communities and their identity or culture (Meerow et al., 2016). Questions such as *resilience of what to what*, or *resilience for whom?* (ibid) become, then, quite pressing, especially for specifying the so-called critical features that stand for the “identity” of the system of interest (viz. above). For example, when Hurricane Katrina devastated the cultural core of New Orleans in 2004, questions were raised about how to build more resilience into the recovering city: was it more important to maintain the structures of the city exactly as they were, preserving neighbourhoods that were culturally significant, and to ensure that the people could come back to the neighbourhoods they lived in before the disaster? Or is the overall resilience of the city structure more important, so that some vulnerable neighborhoods might have to be sacrificed to rebuild better elsewhere, preserving the city’s population but trading away its historical ties? (Kates et al., 2006).

Another important development has to do with the kind of disturbance that resilient systems are supposed to be resilient to. Resilience had been initially applied to *specific* kinds of shocks (sudden and disruptive events) and stresses (long-onset and persistent disturbances upon normal or typical performance). However, following the social turn, resilience began to be interpreted as a more general capacity to withstand various kinds of uncertain stresses and shocks, or combinations of them, at various scales and over an indefinite period –what is known as *general* resilience (Carpenter et al., 2012). General resilience has increasingly attracted attention in contexts such as urban adaptation to climate change or risk management (Cañizares et al., 2021), where the concern is not primarily with single stressors or shocks, but rather with bundles of stressors that appear and disappear or become latent, spanning from the individual to (immediately, through spillovers and cascading effects) the global. Consequently, it is nowadays common to find multi-scalar and general approaches to the resilience of, for example, communities, cities or economies (Norris et al., 2008; Rockefeller Foundation and Arup, 2016).

Increasingly, too, approaches to resilience have become more forward-looking, sometimes captured as ‘bouncing forward’, or transformative, rather than bouncing back (Bahadur & Tanner, 2014). While classic accounts of resilience had already noted that resilience is not mere resistance (Carpenter et al., 2001), recent accounts insist more on the dynamic nature of resilience. It is now accepted that efforts to develop resilience must account for the change that will inevitably occur when responding to a crisis, and moreover, that it is neither possible nor always desirable to return to the previous status quo (Copeland et al., 2020). The features that caused a collapse in a flood protection system, for instance, cannot simply be repaired since

the original system was demonstrably not resilient. Thus, the concept of resilience denotes two complementary but potentially competing challenges in dealing with “disturbances”: the need to prevent collapse by preserving critical functions or features, and the need to change, transform or be adaptable in order to allow for more effective responses to future disturbances (Meerow et al., 2016). Efforts to build resilience can represent conservative measures toward preservation as well as transformative measures to enact necessary changes.

A further important development concerns the normative use of resilience. Prominent accounts of ecological and socio-ecological resilience had tended to portray resilience as a descriptive concept—a property of complex systems in general, which can be good or bad, desirable or not: see, e.g. the above quoted definition by Walker et al. (2004); also (Anderies et al., 2013; Elmqvist et al., 2019). Recently, however, this characterization of resilience has been criticized as incoherent, since, in most if not all its applications, resilience is used as a goal or principle for framing and guiding risk management strategies (Cañizares et al., 2021). This is especially the case in social applications of resilience, which necessarily involve explicitly normative decisions and, moreover, tend to frame resilience as a positive feature or ability (Olsson et al., 2015; Meerow et al., 2016; Thorén & Olsson, 2017).

The next sections return to these topics, especially to questions and concerns about the normativity of resilience. Now we present some tropes of resilience that became quite common during the pandemic. These tropes illustrate the diverse uses to which resilience can be put, as well as some of the tensions that typically underlie usage of this term.

13.4 Resilience Tropes in the Pandemic

Since the pandemic was announced in 2020, we have seen several common tropes arise in media discourse and in the rationales for the policy approaches taken by institutions. Resilience has occupied a prominent place within these discourses. As individuals who find our behaviour mandated by such policies, we have been called upon to help and to ‘build resilience’ in at least three different ways. First, on the personal level, we are guided toward resources that will help us resist the virus and cope with the disruptions that policies such as self-isolation bring to our lives. Second, the social resilience of our communities, cultures and countries, is affected by our individual behavior, which is in turn mandated to enable group-level resilience. Third, on a higher level, the resilience of the human species has been part of debates about policy, and even more so the resilience of our institutions and society as a whole are threatened by the pandemic; certain ways of behaving, we are told, will help us return to ‘normal’ more quickly, where ‘normal’ might mean the freedom to travel, living our social lives, and even returning to the economic stability that many people had and lost with the pandemic.

Individual or personal resilience has been framed in the pandemic discourse both in terms of biological and psychological well-being. In some cases, it rather

straightforwardly refers to physical resilience to the COVID-19 virus and its effects; are individuals healthy and strong enough to suffer from and yet survive both the virus and its knock-on effects? Indeed, some groups are seen as naturally more or less resilient to the effects of COVID-19 and the pandemic countermeasures than others. For example, consider the impact of the pandemic on children who have had to miss education and important social development time with their peers as a result of school and playground closures for extended periods. The phrase ‘kids are resilient’² has been used to suggest that children’s inherent flexibility and ability to adapt will enable them to cope well enough with the changes to their lives required by pandemic restrictions. This trope is also present in various forms of advice given to employees or citizens by their employers or national institutions to be resilient in the face of the challenges brought by the pandemic and related policies. The Mental Health Commission of Canada Working Minds blog, for instance, reminds workers in its ‘Self-care Resilience Guide’ that, “this is a good time to remember...that you have resiliency skills and you can cope”.³ Likewise, the Centre for Disease Control in the U.S. offers individuals a number of “tips to build resilience and manage job stress,” such as “Remind yourself that everyone is in an unusual situation with limited resources.”⁴

Even a fairly straightforward reference to individual bodily health, however, also has a social and cultural context. Some groups have demonstrated greater physical resilience in response to the virus, such as those who already have ‘killer T cells’ remaining from a previous, less dangerous infection (Joy, 2021, in reference to Mallajosyula et al., 2021). Resilience to the virus, and also resilience to the impact of the pandemic as a whole, however, has more often been the consequence of the socio-economic context than of purely biological traits of those groups (Strang et al., 2020; Qureshi, 2021). Thus, the conception of personal resilience here entails the ability to cope well with the broader effects of the pandemic, such as stress, isolation and its economic impact, social determinants of health that in turn affect biological resilience to disease as well. What generally unites these approaches is that they characterize resilience as an available resource that each one of us should be able to draw on.

This reference to the social and cultural context takes us to a second trope, which is rather focused on social resilience, i.e. the resilience of groups or communities. As members of these communities, we are asked to behave in ways that protect the

²For example, as a teacher in the U.S. said in relation to the topic of schools reopening: “It will be a community, and it’s not ideal, but to keep people safe, it is what it is...Kids are resilient, and kids are adaptable.” Retrieved August 2021 from <https://www.alligator.org/article/2020/07/kids-are-resilient-students-and-teachers-respond-to-acps-reopening-plan>

³Retrieved September 2021: Staying Resilience During the COVID-19 Pandemic, Working Minds blog: <https://theworkingmind.ca/COVID19-tim>; Webpage for the Working Mind COVID-19 Self-care and Resilience Guide: <https://theworkingmind.ca/blog/working-mind-COVID-19-self-care-resilience-guide/>

⁴“Employees: How to cope with job stress and build resilience during the COVID-19 pandemic” Updated Dec.23, 2020, Retrieved August 8, 2021. <https://www.cdc.gov/coronavirus/2019-ncov/community/mental-health-non-healthcare.html>

more vulnerable, for example: public mask-wearing as a community-wide mandate ensures that otherwise vulnerable individuals are better protected when they need to travel. Vaccinating oneself contributes to the overall resilience of the group, as well: at the time of writing, the most recent ‘Bloomberg COVID Resilience Ranking’, granted Ireland top spot as ‘best place to be during the pandemic’ because of its high rates of vaccination and policies promoting more social freedoms to the already immunized. The collective action required for pandemic policies to work thus falls under this resilience trope. For instance, again from the ‘tips to build resilience’, the CDC in the United States recommends: “Remind yourself that each of us has a crucial role in fighting this pandemic.” Consequently, we are asked both to build our individual resilience by using the resources available to us, and also to contribute through our individual behavior to building resilience at the community level.

At a more abstract level and with pronounced future-oriented intent, tropes of resilience also call on us to behave or implement policies in ways that would contribute to the resilience of human society, our institutions, and even of certain global social-economic values. One point of debate about national policies has centered around whether certain approaches in pandemic response were aimed at the goal of so-called ‘herd immunity’—while this wasn’t a resilience-based trope *per se*, it does reflect the belief that nations and even the species could be more or less resilient in the future to COVID-19, depending on how we build immunity into the population now. The idea of herd immunity has a straightforward and unproblematic epidemiological rationale insofar as it relates to high vaccination rates—when most of the population is vaccinated, the herd as a whole gets immune. What made it a (problematic) novelty in the context of COVID-19 was that herd immunity approaches were advocated at a time when vaccines against this virus were not yet available. This particular interpretation of ‘herd immunity’ suggested that it might be necessary to allow for some sacrifice of the vulnerable now, in order to gain resilience to the virus at the population level in the future, and it was strongly opposed on both epidemiological and moral grounds (Napier, 2020). Scott Atlas was heavily criticized, for example, for suggesting in his role as advisor of the Trump administration that letting “a lot of people get infected” was an effective strategy for building immunity in the population overall. UK prime minister Boris Johnson was similarly lambasted early on in the pandemic by the president of the British Society for Immunology, for proposing herd immunity as a national strategy.

More direct references to resilience are found in countless articles on the resilience of supply chains, healthcare systems, businesses and other institutions that have been disrupted by the pandemic and, apparently, exposed as insufficiently resilient. Since the coronavirus took to the international stage in 2020, for example, dozens of articles have been published on the topic of the resilience of healthcare systems to pandemics—see e.g. Chaturvedi and Siwan (2020); Wang et al. (2020); Sundararaman et al. (2021); Saulnier et al. (2021). We also mentioned the Bloomberg COVID Resilience Ranking, a regularly revised evaluation of national strategies for dealing with the pandemic, which relies on indicators for healthcare quality, vaccination levels in the population, mortality rates and progress in terms of reopening borders to travel and trade, to assess “where the virus is being handled the most

effectively with the least social and economic upheaval.”⁵ National strategies such as recently announced in the UK are also explicitly turning to resilience as a leading value. Common in the rhetoric of this last trope, therefore, is a focus on system or population level resilience, with a future orientation to using the pandemic as a corrective lesson or for preparing better to avoid similar trouble in the future.

We think that a critical view of resilience could have two normative functions in the pandemic and in similar situations: characterizing the salient moral challenges in this context, and offering some moral guidance for addressing them. To show how, we must first unpack and critically discuss the normative character of these tropes.

13.5 The Normativity of Resilience

As was noted in Sect. 13.2, resilience research features some disputes about whether this term is descriptive or normative. Those who view resilience as a descriptive term often refer to the fact that resilience can denote both positive and negative, moral and immoral, phenomena – there are resilient ecosystems, but also resilient tyrannies (Anderies et al., 2013). While it is unclear that this argument suffices for situating resilience as descriptive (Cañizares et al., 2021), the argument is nonetheless irrelevant in the pandemic context – the tropes of resilience reviewed above present it as a positive feature, and so, as an evaluative term. Moreover, these understandings of resilience are also generally used for implicitly or explicitly making prescriptions.

To explain, evaluative terms are those commonly used for ascribing a positive or negative valence or value to what they describe (Tappolet, 2013). For example, when we say something is beautiful or ugly, we judge it in an aesthetic sense to be good or bad, as having value or not. Virtues and vices are familiar categories of evaluative terms: when we say that someone has the virtue of generosity, we appraise her positively; someone with the vice of meanness is being appraised negatively. Generosity comes from good motives and reasons and leads to good outcomes—without these aspects, giving away one’s money would be frivolous, or if it led to a bad end, irresponsible, rather than indicating the virtuous generosity of the one giving it away. It is typical for evaluative terms to be used to give reasons in favour or against something; it is typically the case that if we assess some action or event as good, we have reasons for doing so and would like it to happen or to be that way. Likewise, assessing something as bad goes hand in hand with its being undesirable. Evaluative language can be used thus to ‘straddle the divide’ between is and ought when an evaluation (an ‘is’) becomes the basis for a prescription (an ‘ought’).

⁵ Retrieved in October 2021, but at the time of writing, the site is still being updated regularly here: <https://www.bloomberg.com/graphics/COVID-resilience-ranking/>

Note that these normative aspects are not always as transparent as they should be. This is most clearly exemplified by the first two tropes explored above, personal resilience and social resilience. In its more medical or biological interpretation, the trope of personal resilience denotes that someone has returned to full health, or that their body and mind have the capacity for responding effectively to viral invasion and the pandemic. More broadly speaking, however, this trope also refers to the resources available to us to care for our mental health and cope with the stresses of lockdown and other changes. The second trope is, as we saw, slightly different: it refers to our ability to harness our individual resilience and put it in service of our community.

Insofar as these tropes refer primarily to the observable signs of resilience, to a naturally occurring property of individuals or groups, or to how possessing certain features tends to result in a resilient outcome, here we might seem to be dealing with a descriptive category. Yet, note that these resources and our ability to harness them are both viewed as positive, insofar as they allow us (or our relatives and communities) to survive, maintain integrity and thrive. Consequently, these tropes are clearly evaluative. At the same time, they are also often used prescriptively, as when we are asked to draw on these resources in order to fight the pandemic, or when we say that ‘kids are resilient’ to advance or justify policies, for instance that prevent them from playing at playgrounds, or advise on their return to school, in favour of allowing other sectors of the economy to open.⁶

Precisely due to its normative implications, in contexts outside the pandemic, this trope of personal resilience has encountered considerable resistance. One common argument against it is that it allows for moral passivity toward the difficulties certain groups endure. For instance, a paper sign quoting Tracy L. Washington, stapled to a lamppost by the Louisiana Justice Institute in New Orleans after Hurricane Katrina, declares: “Don’t call me resilient, Because every time you say, ‘Oh, they’re resilient,’ that means you can do something else to me. I am not resilient.” This trope is also critically portrayed as an intent to escape collective or institutional responsibility for improving social conditions by shifting the responsibility for ensuring resilience away from governing bodies and onto the shoulders of individuals. Psychologist and resilience researcher Michael Ungar (May 2019) put it bluntly in a short essay in the Canadian newspaper, the *Globe and Mail*: “The notion that your resilience is your problem alone is ideology, not science.” Making people responsible for their own resilience is misdirected when their lack of resilience results mostly or even in part from social conditions that are best addressed at higher levels. It is also morally problematic when individuals do not really have the capability of being (more) resilient—that is, when the ‘ought to be resilient’ is not accompanied by the necessary ‘is’. Those points of critique apply even more to the second trope, since social resilience is in many ways a matter of multi-level responsibility, from neighborhood to multilateral international governance, rather

⁶<https://www.macleans.ca/society/health/the-pandemic-is-breaking-parents/>

than just one of personal responsibility. Joseph (2013) has summarized these concerns most sharply by casting resilience as sheer neoliberal jargon.

The normative character of resilience is perhaps more explicit in instances of the third trope, where resilience is viewed as an ideal that the system of interest ought to attain, or progress toward. For instance, a resilient city could be one that is able to maintain what have been deemed its essential features, or one that is capable of improving or growing (progressing) in the face of disturbance. These understandings of urban resilience are quite different, but both are normative. In the former, resilience is about the conservation of something that is assumed to be good. In the latter, it is about transforming in order to improve. Such claims present resilience as a social or political value, that is, a desirable outcome or goal that institutions and systems like cities ought to strive for. Alternatively, resilience is often presented as a virtue: a desirable property of cultures, social organizations or ways of governance. One clear example of this use is the Bloomberg Ranking, whereby countries are deemed better or worse “places to be” during different phases of the pandemic, according to their criteria for handling the virus “most effectively with the least...disruption.” Similarly, organisational theorists have written much about what makes for ‘resilient leadership’ through the pandemic, which illustrates the interpretation of resilience as an ideal or virtue of good governance, organization or business performance (Giustiniano et al., 2020).

These straightforward applications of systems views of resilience to social contexts have also been met with substantial criticism elsewhere, in light of their normative implications. In the development and climate adaptation literature, for instance, it has been claimed that the “apolitical systems perspective” conceals the normative character of resilience (Bahadur & Tanner, 2014). This is held to be morally problematic, since it contributes to depoliticizing resilience-based measures and to promoting a technocratic and managerial mindset that elides possible trade-offs entailed by their application (ibid). Relatedly, some critics note that these perspectives tend to focus on systems properly speaking, such as e.g. in infrastructure or governance systems, while neglecting questions of power, rights of access to goods, and the differential impact of resilience-based measures and policy (Ziervogel et al., 2017). That has led some to question and even reject the idea that we should apply resilience to social contexts, since a return to even an undesirable status quo could be thereby sanctioned as a success (Béné et al., 2012). Scholars in this tradition therefore stress the need to be more explicit about the normative aspects of these system perspectives, especially by engaging with the aforementioned question of resilience for *whom*: who are the beneficiaries of resilience building, and who will be negatively affected by it (Meerow et al., 2016).

Recently, considerations of this sort have in fact prompted a wave of ethical and justice work in resilience research (Bulkeley et al., 2014; Shi et al., 2016; Fitzgibbons & Mitchell, 2019). In line with this work, we argue that making the normativity of the resilience we value explicit—as a set of evaluations that can lead to conflicting prescriptions for action—allows at least for deliberation about the priorities thereby set. Now we will look at how these uses of resilience can both confuse and have the potential to clarify the moral situation at hand in this pandemic.

13.6 Reasoning About and Towards Resilience in the Pandemic Moral Situation

The resilience tropes around the pandemic, we suggest in this section, reflect the fact that we must engage multiple ‘scales’ when reasoning about our behaviour. As resilience is applied to individuals, groups and systems, these tropes advise us to consider factors at diverse levels and concerning different temporal ranges when deciding how we should behave. On the one hand, we must not only consider self-regarding, prudential reasons for our behaviour, but also other-regarding moral reasons at the same time. On the other hand, we are also consistently faced with the dual notions of transformation and preservation. That is, at the same time as we are dealing with current shocks and stressors, we are considering how we ought to improve ourselves and our systems so that this doesn’t happen again (or continue to happen) in the future. These different scales of size and temporality make practical and moral reasoning particularly complex in contexts where iterative shocks and stressors are experienced with an uncertain end and where uncertainty about probable outcomes prevails.

To begin at the systems level, the concerns raised in the last section are somewhat condensed in the case of the idea of population resilience garnered via ‘herd immunity’. As we noted, this was the idea that the survival of the majority of the population could be ultimately achieved by ensuring general immunity to the virus. Like the trope of personal resilience, this theme engages with the idea of survival as a naturally occurring property or ideal, and consequently seems like a simply descriptive category, but it is not. The survival of the numerical majority of a population is, of course, something that we would commonly evaluate as positive or desirable. In addition, the herd immunity approach implicitly prescribes some actions and inactions that are assumed to bring about immunity, such as increasing vaccination rates (the classical epidemiological approach) or limiting the social and institutional interference in people’s normal lives (Sweden’s and Boris Johnson’s infamous approach). That is, resilience as herd immunity is not a naturally occurring or emergent ideal, but a reflection of the priorities we set and of our efforts toward ensuring them.

Yet, the way in which these priorities are set make the goal of herd immunity susceptible to the same objections raised against systems perspectives of resilience more generally. This could be expected, since herd immunity is, in general, a high-level social goal, and moreover one that does not always correlate with positive individual outcomes. Particularly, as Atlas and others (polemically) interpreted herd immunity in the pandemic onset, this idea means that the survival of the majority could be more likely if citizens were to go about their daily lives. By thus promoting herd immunity as a policy goal, then, not only the risks imposed on individuals are minimized, but, indeed, risk-taking social behavior is explicitly promoted among the population. In other words, the rhetorics of herd immunity imply, and at the same time they conceal, a clear conflict between system goals and personal and

community values. Moreover, as we saw, survival is not a matter of simple bodily tolerance to the virus, but is, instead, heavily influenced by socio-economic circumstances. Thus, this case is one where questions over the potential tradeoffs between systems and individual perspectives on governance and policy are particularly critical, and yet in the name of resilience they may be elided, resulting in an intolerable neglect of precisely those who are most vulnerable to the virus and the pandemic in general. The solution here is to avoid using these rhetorics (about resilience or herd immunity) with a descriptive intent, and, instead, to explicitly unpack the normative impact these ideas have when we set them as goals.

At the personal and social levels, there is a range of factors relevant to our moral reasoning about behaviours like self-isolation and its consequences, such as not travelling to see family or moving one's social life online; we ought to consider the impact of those behaviours not only on ourselves and those to whom one usually is morally indebted, but also to the broader public and even the world. As we saw above, resilience is not only a positive characteristic for people to have during the pandemic—individuals are *called upon* to use the tools at their disposal to be more resilient—it is prescribed as a duty, while also describing a characteristic. Yet, while we may assess individuals as resilient or not, if they are not really capable of being more resilient on their own, nor should they thus be fully responsible for that resilience. While each of us is coping with reduced resources and difficulties during the pandemic, these hardships are not evenly distributed nor can they all be coped with well, without sufficient support. Contemporary approaches rather regard personal resilience as a reflection of capabilities and context rather than as an innate resource we can each call up when called upon (Norris et al., 2008). In this way, personal resilience is bound up with the resilience of social groups and systems level institutions: they interact.

Unpacking the normativity of resilience in rhetorical tropes such as the ones we have examined here is a first step toward understanding the moral complexity of the situation we are in. In the literature, as we say above, it has been suggested that unpacking the content of 'resilience' requires asking further questions, namely, resilience to what, of what, and resilience for whom. Asking these questions allows us to deliberate about the evaluative and prescriptive elements of resilience when it is applied as a trope to guide or advise us on how to conceptualise and to cope with the pandemic. Further, they provide a means to address the complexity of the decisions and choices that need to be made about what actions ought to be taken. We show here how the use of resilience in the pandemic rhetoric reveals the different levels on which we must reason about our behavior; as a value or goal, resilience represents the particular moral situation in which we must reason during a pandemic. Consequently, by making its normativity explicit, resilience becomes not only a way to evaluate our behavior, but a frame within which we can deliberate about what we should preserve, about ourselves and about the systems we can influence, and what we should change.

Consider further our early example, of deciding whether to go out to dinner, which requires assessing more than one risk, including risks that one cannot predict. Individuals evaluate their role as potential viral vectors in the pandemic and their

social roles, the roles they play as workers, family members, and citizens. Individuals must consider the changing grounds of policy, science, medicine and resource availability, as well as their own needs and the needs of others who depend upon them. People need to consider factors on ‘multiple scales’ at the same time, temporally and in terms of systems: we need to consider our future while protecting ourselves in the present; we are both individuals and more or less essential parts of a larger ecological, social, economic and technical system. Depending on which scale we might focus on, different decisions will appear morally correct, and it is not unusual for alternatives to conflict. In all cases, the individual remains uncertain about the actual effects of their actions because COVID-19 transmission and its effects can be unpredictable. While this kind of complexity in moral reasoning is not novel, understanding why and how we value resilience in the context of an extended crisis, we suggest, shows us how complex systems can offer more than one and sometimes conflicting options for right action, as well as how we might go about deciding between them.

This moral complexity is illustrated when different answers to ‘resilience to what’ are considered, as they lead to differing responses to ‘resilience for whom’, for instance. To follow lockdown restrictions, for example, resilience to the aggregative effects of self-isolation will be required. This kind of policy, in fact, more or less takes the resilience of individuals to the impact of self-isolation to be a necessary requirement, in order to build a resilient society that also includes vulnerable people (whose risks are in turn intentionally reduced by that policy). This is in sharp contrast to policies like the so-called ‘herd immunity’ approach described above, which proposes instead to ignore the vulnerable in favour of building (a different kind of) resilience for the majority. Examining these policies by differentiating between the normative implications of ‘resilience’ used to promote or explain them, does the work of highlighting the alternatives we have for setting priorities, and their implications for the people involved.

Further, it is necessary to answer the questions, resilience to what, of what, and resilience for whom, to deliberate about what elements in the current system—or features of our current selves—we ought to keep and which ones we should change, given the opportunity to improve. By taking up an explicitly evaluative approach, the answers to these questions will help elucidate the nature of the evaluations we are making and the consequent prescriptions implied. Trade-offs are generally required for resilience, and depending on what they must be resilient to, the what and for whom resilience is a goal will differ. Like the survivors of a pandemic who now have ‘herd immunity’, the city that is deemed resilient in the aftermath of a crisis reflects choices made before and during that crisis about who and what constitutes that city’s identity. In either case, it is possible and essential to deliberate explicitly about the evaluations we are making and their normative weight in terms of the prescriptions they imply.

13.7 Conclusion

Resilience has been applied as a concept and a value in the pandemic and elsewhere. Here we have shown that resilience thinking indeed has much to offer by way of highlighting morally relevant aspects of the pandemic and offering some guidance to moral reasoning in this context. However, as we saw, resilience is not without problems. Here we showed that resilience is a normative concept that is applied at various scales to denote conservation as well as transformation. Due to these features, resilience raises various concerns, for example: what are the things or properties to be conserved and which should be transformed? Who are the beneficiaries and the losers of resilience building? Can high-level systems such as nations be resilient if their citizens are not, and conversely, can we afford to neglect the context and support needed to build personal resilience? As we showed in our analysis of resilience tropes, failure to address these questions may mean missing opportunities for transformation, creating or reproducing tradeoffs between individual resilience and resilience at higher levels, and ultimately losing the potential of this concept for guiding critical and sensitive reflection over the great social challenges that lie ahead.

References

- Alexander, D. E. (2013). Resilience and disaster risk reduction: An etymological journey. *Natural Hazards and Earth System Sciences*, 13(11), 2707–2716. <https://doi.org/10.5194/nhess-13-2707-2013>
- Anderies, J. M., Folke, C., Walker, B., & Ostrom, E. (2013). Aligning key concepts for global change policy: Robustness, resilience, and sustainability. *Ecology and Society*, 18(8). <https://doi.org/10.5751/ES-05178-180208>
- Bahadur, A., & Tanner, T. (2014). Transformational resilience thinking: Putting people, power and politics at the heart of urban climate resilience. *Environment and Urbanization*, 26(1), 200–214. <https://doi.org/10.1177/0956247814522154>
- Béné, C., Wood, R. G., Newsham, A., & Davies, M. (2012). Resilience: New utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction Programmes. *IDS Working Papers*, 2012(405), 1–61. <https://doi.org/10.1111/j.2040-0209.2012.00405.x>
- Brand, F. S., & Jax, K. (2007). Focusing the meaning(s) of resilience: Resilience as a descriptive concept and a boundary object. *Ecology and Society*, 12(1). <https://doi.org/10.5751/es-02029-120123>
- Brown, K. (2012). Policy discourses of resilience. In M. Pelling, D. Manuel-Navarrete, & M. Redclift (Eds.), *climate change and the crisis of capitalism* (pp. 37–50). Routledge.
- Bulkeley, H., Edwards, G. A. S., & Fuller, S. (2014). Contesting climate justice in the city: Examining politics and practice in urban climate change experiments. *Global Environmental Change*, 25, 31–40. <https://doi.org/10.1016/j.gloenvcha.2014.01.009>
- Cañizares, J. C., Copeland, S. M., & Doorn, N. (2021). Making sense of resilience. *Sustainability*, 13(15), 8538.
- Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From Metaphor to Measurement: Resilience of What to What?. *Ecosystems* 4(8), 765–781. <https://doi.org/10.1007/s10021-001-0045-9>
- Carpenter, S. R., & Brock, W. A. (2008). Adaptive capacity and traps. *Ecology and Society*, 13(40).

- Carpenter, S. R., Arrow, K. J., Barrett, S., Biggs, R., Brock, W. A., Crépin, A.-S., ... Zeeuw, A. D. (2012). General resilience to cope with extreme events. *Sustainability*, 4(12), 3248–3259.
- Chaturvedi, M., & Siwan, R. M. (2020). Resilience of healthcare system to outbreaks. In *Integrated risk of pandemic: COVID-19 impacts, resilience and recommendations* (pp. 397–412). Springer Singapore.
- Copeland, S., Comes, T., Bach, S., Nagenborg, M., Schulte, Y., & Doorn, N. (2020). Measuring social resilience: Trade-offs, challenges and opportunities for indicator models in transforming societies. *International Journal of Disaster Risk Reduction*, 51. <https://doi.org/10.1016/j.ijdrr.2020.101799>
- Doorn, N. (2015). Resilience indicators: Opportunities for including distributive justice concerns in disaster management. *Journal of Risk Research*, 20(6), 711–731. <https://doi.org/10.1080/013669877.2015.1100662>
- Elmqvist, T., Andersson, E., Frantzeskaki, N., McPhearson, T., Gaffney, O., Takeuchi, K., & Folke, C. (2019). Sustainability and resilience for transformation in the urban century. *Nature Sustainability*, 2. <https://doi.org/10.1038/s41893-019-0250-1>
- Elster, J. (1983). *Sour grapes: Studies in the subversion of rationality*: Editions De La Maison des Sciences De L'Homme.
- Fitzgibbons, J., & Mitchell, C. L. (2019). Just urban futures? Exploring equity in “100 resilient cities”. *World Development*, 122, 648–659. <https://doi.org/10.1016/j.worlddev.2019.06.021>
- Giustiniiano, L., Cunha, M. P., Simpson, A. V., Rego, A., & Clegg, S. (2020). Resilient leadership as paradox work: Notes from COVID-19. *Management and Organization Review*, 16(5), 971–975.
- Gunderson, L., & Holling, C. S. (2002). *Panarchy: Understanding transformations in human and natural systems*. Island Press.
- Hansson, S. O. (1996). Decision making under great uncertainty. *Philosophy of the Social Sciences*, 26(3), 369–386. <https://doi.org/10.1177/004839319602600304>
- Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, 4(1), 1–23. <https://doi.org/10.1146/annurev.es.04.110173.000245>
- Holling, C. S. (1978). *Adaptive environmental assessment and management*. John Wiley.
- Holling, C. S. (1996). Engineering resilience versus ecological resilience. In P. E. Schulze (Ed.), *Engineering within ecological constraints* (pp. 31–43). National Academy Press.
- Hollnagel, E., Woods, D. D., & Leveson, N. (2006). *Resilience engineering: Concepts and precepts*. Ashgate Publishing Limited.
- Hughes, T. P., Bellwood, D. R., Folke, C., Steneck, R. S., & Wilson, J. (2005). New paradigms for supporting the resilience of marine ecosystems. *Trends in Ecology and Evolution*, 20(7), 380–386. <https://doi.org/10.1016/j.tree.2005.03.022>
- Joseph, J. (2013). Resilience as embedded neoliberalism: A governmentality approach. *Resilience*, 1(1), 38–52. <https://doi.org/10.1080/21693293.2013.765741>
- Joy, H. (2021). Here's why some people are more resilient to Covid-19. July 3. <https://www.medindia.net/news/heres-why-some-people-are-more-resilient-to-covid-19-202076-1.htm>
- Kates, R. W., Colten, C. E., Laska, S., & Leatherman, S. P. (2006). Reconstruction of New Orleans after hurricane Katrina: A research perspective. *Proceedings of the National Academy of Sciences of the United States of America*, 103(40), 14653–14660. <https://doi.org/10.1073/pnas.0605726103>
- Mallajosyula, V., Ganjavi, Chakraborty, S., McSween, A. M., Pavlovitch-Bedzyk, A. J., Wilhelm, J., Nau, A., Manohar, M., Nadeau, K. C., & Davis, M. M. (2021). CD8+ T cells specific for conserved coronavirus epitopes correlate with milder disease in patients with COVID-19. *Science Immunology*, 6(61). <https://doi.org/10.1126/sciimmunol.abg5669>
- Meerow, S., & Stults, M. (2016). Comparing conceptualizations of urban climate resilience in theory and practice. *Sustainability*, 8(7), 701.
- Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. *Landscape and Urban Planning*, 147, 38–49. <https://doi.org/10.1016/j.landurbplan.2015.11.011>

- Napier, A. D. (2020). I heard it through the grapevine: On herd immunity and why it is important. *Anthropology Today*, 36(3), 3–7. <https://doi.org/10.1111/1467-8322.12572>
- Norris, F., Stevens, S., Pfefferbaum, B., Wyche, K., & Pfefferbaum, R. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology*, 41, 127–150. <https://doi.org/10.1007/s10464-007-9156-6>
- Olsson, L., Jerneck, A., Thoren, H., Persson, J., & O’Byrne, D. (2015). Why resilience is unappealing to social science: Theoretical and empirical investigations of the scientific use of resilience. *Science Advances*, 1(4), e1400217. <https://doi.org/10.1126/sciadv.1400217>
- Qureshi, S. (2021). Pandemics within the pandemic: Confronting socio-economic inequities in a datafied world. *Information Technology for Development*, 27(2), 151–170. <https://doi.org/10.1080/02681102.2021.1911020>
- Rockefeller Foundation, & Arup. (2016). *City resilience index: Understanding and measuring City resilience*. Retrieved from Available online: https://assets.rockefellerfoundation.org/app/uploads/20171206110244/170223_CRIBrochure.pdf
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., III, Lambin, E., ... Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society*, 14(2). <https://doi.org/10.5751/es-03180-140232>
- Roy, A. (2020). The pandemic is a portal. *Financial Times*. Retrieved from https://www.ft.com/content/10d8f5e8-74eb-11ea-95fe-fcd274e920ca?fbclid=IwAR3Z7Pa2EeS3r4zS7eY0amvqzBPcDRCuct5Dm8QRtMp1rY_bi0nFUM6WxA
- Saulnier, D. D., Blanchet, K., Canila, C., Cobos Muñoz, D., Dal Zennaro, L., de Savigny, D., ... Tediosi, F. (2021). A health systems resilience research agenda: Moving from concept to practice. *BMJ Global Health*, 6(8), e006779. <https://doi.org/10.1136/bmjgh-2021-006779>
- Shaw, D. (2021). COVID-19 conscience tracing: Mapping the moral distances of coronavirus. *Journal of Medical Ethics*, 1–4. <https://doi.org/10.1136/medethics-2021-107326>
- Shi, L., Chu, E., Anguelovski, I., Aylett, A., Debats, J., Goh, K., ... VanDeveer, S. D. (2016). Roadmap towards justice in urban climate adaptation research. *Nature Climate Change*, 6(2), 131–137. <https://doi.org/10.1038/nclimate2841>
- Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience definitions, theory, and challenges: Interdisciplinary perspectives. *European Journal of Psychotraumatology*, 5. <https://doi.org/10.3402/ejpt.v5.25338>
- Stirling, A. (2010). Keep it complex. *Nature*, 468(7327), 1029–1031. <https://doi.org/10.1038/4681029a>
- Strang, P., Fürst, P., & Schultz, T. (2020). Excess deaths from COVID-19 correlate with age and socio-economic status. A database study in the Stockholm region. *Upsala Journal of Medical Sciences*, 125(4), 297–304. <https://doi.org/10.1080/03009734.2020.1828513>
- Strunz, S. (2012). Is conceptual vagueness an asset? Arguments from philosophy of science applied to the concept of resilience. *Ecological Economics*, 76, 112–118. <https://doi.org/10.1016/j.ecolecon.2012.02.012>
- Sundararaman, T., Muraleedharan, V. R., & Ranjan, A. (2021). Pandemic resilience and health systems preparedness: Lessons from COVID-19 for the twenty-first century. *Journal of Social and Economic Development and Cultural Change*, 1–11.
- Tappolet, C. (2013). Evaluative vs. deontic concepts. In *International encyclopedia of ethics*.
- Teschl, M., & Comim, F. (2005). Adaptive preferences and capabilities: Some preliminary conceptual explorations. *Review of Social Economy*, 63(2), 229–247. <https://doi.org/10.1080/00346760500130374>
- Thorén, H., & Olsson, L. (2017). Is resilience a normative concept? *Resilience*, 6(2), 112–128. <https://doi.org/10.1080/21693293.2017.1406842>
- Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. P. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, 9(2). <https://doi.org/10.5751/es-00650-090205>

- Wang, Z., Duan, Y., Jin, Y., & Zheng, Z. J. (2020). Coronavirus disease 2019 (COVID-19) pandemic: How countries should build more resilient health systems for preparedness and response. *Global Health Journal*, 4(4), 139–145. <https://doi.org/10.1016/j.glohj.2020.12.001>
- Wardekker, J. A., de Jong, A., Knoop, J. M., & van der Sluijs, J. P. (2010). Operationalising a resilience approach to adapting an urban delta to uncertain climate changes. *Technological Forecasting and Social Change*, 77(6), 987–998. <https://doi.org/10.1016/j.techfore.2009.11.005>
- Woods, D. D. (2015). Four concepts for resilience and the implications for the future of resilience engineering. *Reliability Engineering and System Safety*, 141, 5–9. <https://doi.org/10.1016/j.res.2015.03.018>
- Ziervogel, G., Pelling, M., Cartwright, A., Chu, E., Deshpande, T., Harris, L., ... Zweig, P. (2017). Inserting rights and justice into urban resilience: A focus on everyday risk. *Environment and Urbanization*, 29(1), 123–138. <https://doi.org/10.1177/0956247816686905>

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

