The dynamics of costly social norms[1]

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Social norms that are costly for individuals can remain in place for a long time because of social pressure to conform. Examples include duelling, footbinding, female genital cutting, and norms of conspicuous consumption. These and other costly norms are rarely 'all-or-nothing'; instead, they take on many alternative forms. We develop a theory of norm dynamics that allows for such intermediate forms. The theory predicts rich dynamics that are consistent with cases where norm shifts have been documented.

1 Introduction

Early one morning in 1804, Alexander Hamilton and Aaron Burr left Manhattan in separate boats and rowed to New Jersey. At the time, duelling was outlawed in many states and it was common for New Yorkers to duel in New Jersey because the ban was less strictly enforced. Pistols were hidden in a bag, allowing the rowers to declare under oath that they had not seen any; they also stood with their backs to the duellists. Although Hamilton was morally opposed to duelling and felt that it would be irresponsible towards his wife and children, he decided to go ahead with the duel anyway, because of the threat of public discredit. On the day of the duel, Hamilton missed, perhaps intentionally; Burr hit and mortally wounded Hamilton, who died the following day.[4]

Duelling is an example of a costly social norm. A social norm is a behaviour or set of behaviours that people engage in because it is prescribed by society. A costly social norm is one that entails a cost to the agents following it. In the

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4 Chernow 2004, §42.

case of duelling, the cost could be very high: it is estimated that more than a third of duels in the early nineteenth century in France ended in the death of one of the duellists,[5] and duelling was generally illegal and decried by institutions such as the Church. Yet people, for the most part, felt compelled to follow the norm. Contemporary accounts make it clear that social pressure was a significant motivation: people were concerned about loss of esteem from their peers if they failed to challenge someone to a duel when one was expected, or failed to accept a duel, or in any way breached the norms surrounding duelling, and this concern was sufficient to drive them to risk their lives. The most striking illustrations of this are the numerous instances of people duelling despite being opposed to the practice, including Hamilton.

Social norms often govern a set of behaviours rather than a single behaviour, and they can take many intermediate forms that are more or less costly. In the case of duelling, convention regulated when it was appropriate to challenge someone to a duel, how the duel should be organised, what type of weapons should be used, and so forth. Moreover, these conventions differed from place to place and changed over time. Until the mid-sixteenth century duellists in France and England predominantly used slashing broadswords and protected themselves with bucklers. Eventually, broadswords were replaced by rapiers, which were far more deadly since they could more easily damage internal organs.[6] When pistols became popular in the late eighteenth century the distance separating the duellists, which heavily influenced both accuracy and lethality, was the subject of strong restrictions. The conventional distance was ten or twelve paces, which might be reduced if the duel was particularly serious, or increased if the converse was true.[7] Duellists who stood at smaller distances were considered reckless; those who stood further were considered cowardly; both were often the subjects of social opprobrium. Although duellists who were considered to have followed conventions were not always the subject of legal pursuits, this leniency never applied to those who had breached them.[8] In a popular duelling manual, the comte de Chatauvillard wrote that ‘honour might require us to risk our lives, but not to play with them’.[9]

In the United Kingdom, duelling died out suddenly in the mid-nineteenth century (Banks 2008), whereas in France it endured up to the turn of the century,

5 Chesnais 1981, 103.
6 Stone 1965, 242–44.
7 Hopton 2007, 81–83.
8 Hopton 2007, 30–33.
9 Cited in Nye 1993, 142.

albeit in a different form.[10] Swords became popular again,[11] and, increasingly, the risks involved in duelling were made explicit: duels were announced in advance as being *au premier sang*, to serious wounds, or, rarely, *à la mort*.[12] These changes had the effect of drastically reducing fatality rates. By the second half of the nineteenth century, only around two percent of duels ended in the death of one of the duellists.[13] The change was so significant that duellists became the subject of ridicule, to the extent that Mark Twain was moved to write in 1880 after visiting France:

> Much as the modern French duel is ridiculed by certain smart people, it is in reality one of the most dangerous institutions of our day. Since it is always fought in the open air, the combatants are nearly sure to catch cold.[14]

Other examples of costly social norms include footbinding, female genital cutting, and norms of conspicuous consumption. Footbinding was prevalent for over a millennium in China, from the tenth century to the turn of the twentieth century. The process of footbinding started around the age of six, before the arches of the feet were fully developed, and took years. The feet were broken, folded on themselves, and bound tightly with bandages to mould them to the desired shape: a compressed arched foot around ten centimetres in length.[15] The bandages were redone and tightened regularly for the next six to ten years. The whole procedure was extremely painful, and frequently led to infection. It is thought that as many as ten percent of girls subjected to the process did not survive. Those who did were hobbled. There was considerable social pressure to conform to the norm: footbinding was considered attractive, a sign of wealth and status; parents considered it necessary for a proper marriage and feared that they would be unable to find a match for their daughters if they did not have their feet bound.[16]

As with duelling, there was variation in the norm across time and place. Remains from the 13th century show women with bound feet, but not as small as the later ten-centimetre ideal.[17] There were also distinct regional variants of the norm,

10 Hopton 2007, 323.
11 Nye 1993, 186.
12 Hopton 2007, 79.
13 Banks 2012, 49–50.
14 Twain (1880) 1997, 38.
15 Mackie 1996, p. 1000.
16 Mackie 1996, p. 1002.
17 Ko 2007, pp. 187–91.

for instance in Sichuan, where people practised a less severe form of footbinding that did not involve distorting the heel.[18] Governments attempted to outlaw the practice on at least two occasions, in 1665 and 1847, but were unsuccessful. Towards the end of the nineteenth century, footbinding fell increasingly out of favour in public opinion and became seen as incompatible with modern Chinese society. It was condemned by Chinese intellectuals and Western missionaries, and by the end of the nineteenth century, a number of anti-footbinding societies had formed. By all accounts, the demise of footbinding was fast. In 1908, the majority of public opinion was opposed to footbinding, and by the 1920s, it had all but disappeared in the new generation.[19]

A contemporary example of a costly social norm is female genital cutting (FGC), which is defined as the practice of cutting or removing part of the external female genitalia for non-medical reasons and is practised in parts of Africa and the Middle East.[20] An estimated 200 million women are cut worldwide. It has serious health consequences both at the time of cutting and in the long run, including chronic pain, increased risk of infections, and increased mortality risk. In spite of these costs, FGC is held in place by community norms: girls who do not undergo the procedure may be excluded from the social circle of adult women and have significantly reduced marriage prospects.[21] FGC takes several forms that differ in how harmful they are. In Somalia, for example, two forms are prevalent: Pharaonic, the more severe form, and Sunna. In recent years, Sunna has displaced Pharaonic as the most common form of the practice. This shift appears to be tied to the endorsement of Sunna by religious leaders in the 1990s as well as campaigns by NGOs. An important policy question is whether the future trajectory is likely to lead to complete abandonment of FGC (in both forms), or whether Sunna will become entrenched as a new norm.[22]

Norms of conspicuous consumption, which were first studied systematically by Veblen (1899), involve people spending large sums of money on goods and services whose main purpose is to display wealth and status. Today, with the success of the luxury industry, they are pervasive in society. People may feel pressure to consume certain goods in order to maintain status among peers (as captured by the idiom 'keeping up with the Joneses') or to gain entry into a social group. A

18 Gates 2015, p. 7.
19 Mackie 1996, p. 1001.
20 Yoder, Wang, and Johansen 2013.
21 Shell-Duncan et al. 2011.
22 See Gulesci et al. (2023) for an analysis of this question using field data.

striking contemporary example is that of ‘super-yachts’, which are a means for the most wealthy members of society to distinguish themselves from the rest: ‘Even among the truly rich, there is a gap between the haves and the have-yachts.’[23] In the past twenty years, the average length of a luxury yacht has crept up from 60 to 80 metres. According to a Silicon Valley CEO, until recently ‘a fifty-metre boat was considered a good-sized boat. Now that would be a little bit embarrassing.’ This illustrates the normative aspect of conspicuous consumption: the acceptable level of consumption depends on what others are consuming.

Another example of a norm of conspicuous consumption was the fashion among wealthy women for wearing platform shoes known as chopines in Renaissance Venice, and subsequently across Europe. The height of the shoes symbolised the status of the wearer and allowed her to tower over others.[24] Over time, chopines gradually increased in height until they became almost unwearable: some were over fifty centimetres tall and wearers required a servant to help them walk. Higher chopines also entailed a higher monetary cost, both because the shoes themselves were costlier and because the wearer would need longer dresses. In 1430, a law attempted to limit their height to three inches, but was widely flouted.[25] Eventually, in the seventeenth century, chopines fell out of fashion as heels became popular.[26]

These five examples exhibit some common features. First, they are persistent. Many have endured for centuries despite attempts to extirpate them. Second, they are not ‘all-or-nothing’. Instead, each norm has taken on several alternative forms over time, which can be more or less costly. Third, adherence to norms is motivated by social pressure. People face censure or loss of status if they fail to display certain behaviours. This pressure may be positive or negative: in the case of duelling, any deviation from the norm was sanctioned; in the case of conspicuous consumption, people may lose status if they consume little, but may gain status if they consume more. Fourth, they display rich dynamics. Duelling in the UK died out suddenly, as did footbinding. Duelling in France transitioned to an intermediate norm before disappearing, and FGC in Somalia may follow a similar

23 See ‘The floating world’ by E. Osnos in the *New Yorker* issue dated 25 July 2022.

24 In Shakespeare’s *Hamlet*, the prince greets one of the players and comments that ‘your ladyship is nearer to heaven than when I saw you last, by the altitude of a chopine’ (2.2.427).

25 The pervasiveness of such sumptuary laws, which regulated expenditure on consumption goods, demonstrates the extent to which conspicuous consumption was considered problematic (Riello and Rublack 2019). A contemporary example is school uniforms, which proponents argue curtail social pressure to own branded clothing.

26 Bossan 2012, p. 35.

pattern. Norms of conspicuous consumption, including yachts and chopines, tend to escalate gradually and may abruptly go out of fashion.

Changes in social norms are often linked to wider societal changes. For example, one explanation for the decline in duelling in Europe and footbinding in China is that industrialisation and urbanisation over the course of the nineteenth century led to a weakening of the reliance on social ties, making costly social norms harder to enforce. Social changes also reframed perceptions of these norms, which became viewed as outdated and pernicious.[27] Another example is the change in the perception of the intermediate form of FGC in Somalia following guidance by religious leaders.[28]

The present paper develops a theory of the dynamics of costly norms that illuminates these examples. Following G. A. Akerlof (1997) and Brock and Durlauf (2001), we consider a model in which agents choose an action with an associated *intrinsic utility* as well as a *social utility* that increases as the discrepancy between one's own action and the actions of others increases. If an agent chooses a less costly action than others, her intrinsic utility will be high, but her social utility will be low. If she chooses a costlier action, her intrinsic utility will be low and her social utility may be high or low, depending on how costlier actions are viewed by society. Whereas the existing literature has focussed on static equilibrium, we consider a dynamic model in which agents update their actions at randomly determined intervals and best-respond to the current state of the process.

We focus on the interim dynamics of the process; that is, we are interested in the following question: If the process starts at a particular norm, what will be the next norm? In contrast, existing research focusses either on static equilibria (G. A. Akerlof 1997; Brock and Durlauf 2001) or on long-run analysis (Young 1993, 1998; Kandori, Mailath, and Rob 1993; Bowles 2006). The model predicts rich dynamics that are consistent with the actual dynamics of the examples discussed. Moreover, we show how these dynamics depend on the trade-off between intrinsic and social utility. We provide conditions under which costly norms will tend to collapse suddenly (as was the for duelling in the United Kingdom and footbinding in China), as well as conditions under which they may transition via lower-cost variants (as was the case for duelling in France and may be the case for FGC in Somalia). We also provide conditions under which norms will escalate gradually before collapsing (which fits the case of conspicuous consumption). We argue that

27 Banks 2008; Mackie 1996.
28 Gulesci et al. 2023.

these conditions are plausible in each of the examples.

2 Related literature

There is a wide-ranging literature on the dynamics of norms that spans economics, sociology, philosophy, and political science.[29] Schelling (1978) was one of the first to introduce a game-theoretic explanation of norms in terms of coordination equilibria, and to analyse norm shifts using the concept of tipping points. Mackie (1996) extended this framework to analyse the persistence of costly norms, such as female genital cutting and footbinding, and argued that targeted intervention at the level of subgroups can be particularly effective in overturning such norms. Another key contributor to the economic analysis of norms is G. A. Akerlof (1980, 1997), who argued that social interactions and the attendant pressure to adhere to established norms of behaviour can lead to inefficient equilibrium traps from which it is difficult to escape.

Evolutionary game theory has emerged as a useful tool for analysing norm dynamics (Young 1993, 1998; Kandori, Mailath, and Rob 1993; Bowles 2006).[30] This methodology allows one to analyse how systems of interacting agents converge to normative behaviours from out-of-equilibrium conditions, and how shifts between norms are induced by exogenous or endogenous variations in payoffs. Applications to specific examples include contractual norms in agriculture (Young and Burke 2001), the evolution of property rights (Bowles and Choi 2013, 2019), norms of medical practice (Burke, Fournier, and Prasad 2010), inferior institutions and forms of organisation (Belloc and Bowles 2013), and signalling norms such as veiling among Muslim women (Carvalho 2013). The present paper also adopts this framework, but we focus on interim instead of long-run dynamics.

The closest paper in the literature is the study of FGC practices in Somalia by Gulesci et al. (2023). Like the present paper they analyze the dynamics of norm transition when there are intermediate actions. In particular they study the case where there are three actions – high, medium, and low cost – and identify conditions under which the medium cost action serves as a ‘stepping stone’ from

29 See among others Schelling 1978; G. A. Akerlof 1980; Axelrod 1986; Skyrms 1996, 2003; Mackie 1996; Young 1998, 2015; G. A. Akerlof and Kranton 2000; Blume and Durlauf 2001; Brock and Durlauf 2001; Bowles 2004; Bicchieri 2005; G. A. Akerlof and Kranton 2010; and R. Akerlof 2017.

30 For book-length treatments of evolutionary game theory and its applications see Weibull 1995; Samuelson 1997; Young 1998; Vega-Redondo 1996; Bowles 2004; and Boyd and Richerson 2005.

the high-cost to the low-cost action. In the present paper, by contrast, we analyze situations where there are any number of intermediate actions and characterize the qualitative dynamics that can arise.

3 A model of costly social norms

There is a finite set of actions $A = \{0, 1, 2, \ldots, n\}$, which may capture behaviours along multiple dimensions. In the case of duelling, agents might be more or less prone to challenging other people to duel and more or less prone to accepting challenges; they might choose one weapon over another; if they fight with pistols, they might stand closer or further apart. In the case of conspicuous consumption, by contrast, there is a single dimension: the monetary cost.

There is a finite number of agents m, which is assumed to be large. Let $\delta = 1/m$. A *state* $p = (p_0, p_1, \ldots, p_n)$ specifies the proportion of agents choosing each action. Let $\Delta = \{p \in \mathbb{R}_+^{n+1} : \sum_{i \in A} p_i = 1\}$ denote the n-dimensional simplex and $\tilde{\Delta}$ denote the set of feasible states; that is,

$$\tilde{\Delta} = \{p \in \Delta : p_i \in \{0, \delta, 2\delta, \ldots, 1\} \text{ for each } i \in A\}. \tag{1}$$

An agent's utility from choosing an action has two components: intrinsic and social. Let $c_i \geq 0$ be the *cost* of action $i \in A$. For the sake of convenience, we assume that costs are distinct. Without loss of generality, we shall order the actions so that $c_0 < c_1 < \cdots < c_n$ and normalise $c_0 = 0$.

The *social utility* of an action represents the pressure to conform. This pressure may be external (agents shun, express disapproval towards, or break off relations with those who adopt improper actions) or internal (agents feel shame or inadequacy). Social pressure is higher the greater the deviation. For instance, someone who refuses to duel altogether might suffer greater social discredit than one who chooses swords when pistols are expected, while a billionaire will suffer a greater loss of status the smaller her yacht is relative to those of other billionaires. Equally, social pressure may operate to discourage costly choices. For instance, someone may be chastised for duelling over a petty dispute, and ostentatious displays of wealth may be viewed as distasteful and vulgar.

We capture these incentives through a *social utility function*, which depends on the proportion of agents choosing each action in the current state. It will be convenient to distinguish between pressure not to choose uncostly actions and pressure not to choose costly actions. We refer to the former as the *inadequacy* *motive* and the latter as the *restraint motive*. We will consider the possibility that agents derive utility from choosing costlier actions than others in section 5. The *social utility* of an agent playing action $i \in A$ in state $p \in \tilde{\Delta}$ is

$$-\sum_{j \in A} p_j(\iota(c_j - c_i) + \rho(c_i - c_j)), \tag{2}$$

where $\iota, \rho : \mathbb{R} \to \mathbb{R}_+$ are nondecreasing and satisfy $\iota(d) = \rho(d) = 0$ for any $d \leq 0$. Note that the social utility of an agent choosing i when all other agents are choosing $j > i$ is $-\iota(c_j - c_i)$; similarly, the social utility of an agent choosing i when all other agents are choosing $j < i$ is $-\rho(c_i - c_j)$. Thus ι and ρ capture the inadequacy and restraint motives, respectively. Following G. A. Akerlof (1997) and Brock and Durlauf (2001), and for simplicity, we have assumed that the difference in cost between actions is a proxy for the disparity between them.

The fact that ι and ρ are nondecreasing implies that social utility is lower the further the deviation. That is, someone who owns a small yacht may still have more status than someone who doesn't own a yacht at all. Similarly, if the convention is to duel with pistols at ten paces, someone who requests to duel at five paces is more likely to be viewed as reckless and suffer social opprobrium than someone who requests to duel at eight. In what follows, we will assume $\iota(d) > 0$ for all $d > 0$, but we allow $\rho(d) = 0$ for all d.

Assume that intrinsic and social utilities are separable. Thus the total utility of an agent playing action i in state p is

$$v_i(p) = -c_i - \lambda \sum_{j \in A} (\iota(c_j - c_i) + \rho(c_i - c_j))p_j, \tag{3}$$

where $\lambda \geq 0$ captures the importance of social relative to intrinsic utility. There is a trade-off between individual and social utility: a costly action may be preferable to a less costly one if there are more people playing it or actions close to it.

Let p^i denote the state in which all agents play action i; such a state is *homogenous*. For $i \neq j$, define the unit-switching vector $e^{ij} \in \mathbb{R}^n$ as follows: $e^{ij}_i = -\delta$, $e^{ij}_j = \delta$, and $e^{ij}_k = 0$ for $k \neq i, j$. Thus if the current state is p and an agent switches from i to j, the new state is $p + e^{ij}$. It will be convenient to let $e^{ii} = (0, \ldots, 0)$ for all i. A state is *stable* if it is a strict Nash equilibrium. Formally, for all i such that $p_i > 0$ and for all j, $v_i(p) > v_j(p + e^{ij})$. (The unit-switching vector accounts for the fact that an agent's switching changes the state.) A *norm* is a homogeneous, stable state. For simplicity, we will also refer to $i \in A$ as a norm if p^i is stable.

Let $A^* = \{i \in A : p^i \text{ is stable}\}$ be the set of norms.

Each period, an agent is chosen at random to update her action and chooses a best response to the current state (if there are multiple best responses, she chooses one at random with uniform probability).

In many of the examples cited, deviations take on a symbolic dimension and one would expect even small deviations to incur substantial social cost. For example, suppose that someone requests to duel at eleven paces when the conventional distance is ten. This may lead to accusations of cowardice and be treated much the same as a request to duel at twelve paces: both are 'not the done thing'. Equally, in the case of conspicuous consumption, it may be that ordinal comparisons are at least as important as the cardinal comparisons: if someone owns a super-yacht that is only a foot longer than someone else, they still own the longer super-yacht. Thus, small differences in consumption may be relatively more important than large differences.

To capture this idea, assume $\iota(d)/d$ is decreasing on $\mathbb{R}_{++}$. Intuitively, social utility becomes less important relative to intrinsic utility for larger differences. This condition is implied by concavity of ι but is weaker. For instance, the functions in figures 1a and 1b satisfy it, but the function in figure 1c does not. (We do not impose this assumption on ρ.)[31]

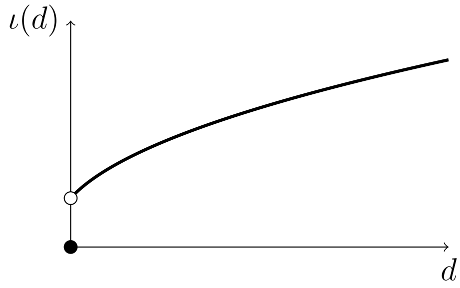
4 Norm convergence and collapse

We now turn to the analysis of the model. We begin by showing that the process always reaches a norm from any starting state. All proofs are relegated to the appendix.

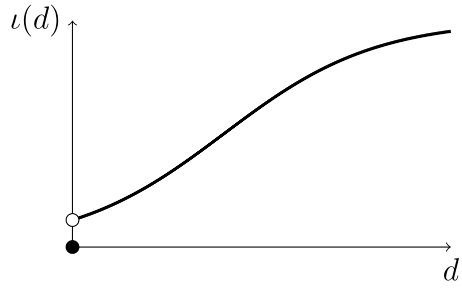
Theorem 1. *From any state, the process converges to a norm in finite time with probability one.*

The fact that the utility of an action depends not only on the number of agents choosing that action, but also on what actions the other agents choose, makes the dynamics complex and means that existing results are not applicable. In particular, the game is not a potential game (Monderer and Shapley 1996).

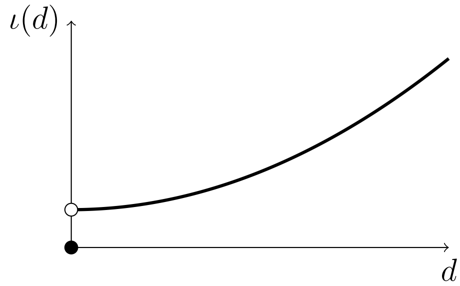
31 An important point to note is that although the social utility function is defined on a continuum, we assume that the actions come in focal, discrete packages. This fits many of the examples we discuss; for example, one would not request to duel at 10.2 paces or brag about a super-yacht measuring 75 feet and three inches. Yoeli et al. (2022) argue that norms will tend to be categorical. Yan, Mathew, and Boyd (2023) show that continuous norms may be unstable.



(a) Concave.



(b) Neither concave nor convex.



(c) Convex.

Figure 1: The shape of the inadequacy function. (a) and (b) satisfy $\iota(d)/d$ decreasing, but (c) does not.

The proof actually makes it clear that the result is more general than stated in theorem 1 and is of independent interest. In particular, it implies that any finite and symmetric game with strict preference for coordination is weakly acyclic, and therefore admits a Nash equilibrium in pure strategies.[32]

Theorem 2 below characterises the dynamics of the process following societal changes that alter the importance of social relative to intrinsic utility, as captured by the parameter λ.

Theorem 2. *Suppose the process starts at some norm i.*

1. *If λ increases, then the current norm stays in place.*
2. *If λ decreases, then either the current norm stays in place or 0 is chosen in every subsequent period.*

Theorem 2 implies that a decrease in the importance of social utility can lead to a *collapse* in a costly norm. This is consistent with the dynamics of both duelling in the UK and footbinding in China.

32 Weak acyclicity was introduced by Young (1993). Strict preference for coordination is the property that a player's utility strictly increases whenever another player switches to her action.

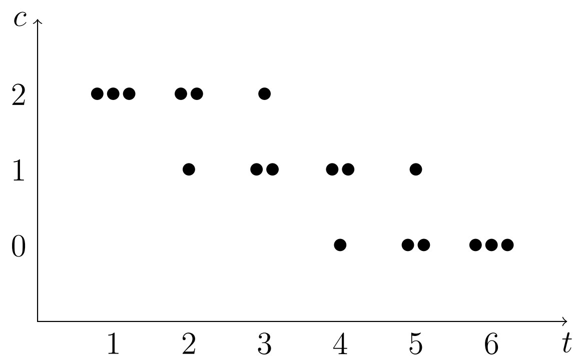


Figure 2: If $\iota(d)/d$ is increasing, gradual erosion can occur.

Theorem 2 depends on the assumption that $\iota(d)/d$ is decreasing. If this doesn't hold, then the process can transition via intermediate actions instead of collapsing. The following example illustrates.

Example 1. Suppose $m = 3$, $n = 2$, $c_i = i$, $\rho(d) = 0$ for all $d \in \mathbb{R}$, and $\iota(d) = d^2$ for all $d \geq 0$. Suppose the process starts at p^2. Suppose $\lambda = 2$ initially but then the parameter decreases to $\lambda' = 1$.

At λ, starting from p^2, action 2 yields -2, whereas 1 yields $-1-\lambda\frac{2}{3}(2-1)^2 = -\frac{7}{3}$ and 0 yields $-0 - \lambda\frac{2}{3}(2-0)^2 = -\frac{19}{3}$, so agents have no incentive to deviate. However, at λ', 1 yields $-1-\lambda'\frac{2}{3}(2-1)^2 = -\frac{5}{3}$ and 0 yields $-0-\lambda'\frac{2}{3}(2-0)^2 = -\frac{11}{3}$, so agents have an incentive to switch to 1. After an agent switches, one can check that 1 remains the unique best response for all players, so any updating agent will choose 1. Once a single agent remains at 2, 0 becomes a best response for that agent. Continuing in this way, the process converges to p^0. Section 4 illustrates the path of the process; the dots indicate the number of agents choosing each action in each period.

Example 1 shows a case in which the process gradually erodes to the uncostly norm. Note that another possible dynamic when $\iota(d)/d$ is not decreasing is for the process to converge to an intermediate norm.

The case in which $\iota(d)/d$ is increasing corresponds to situations in which large deviations result in relatively high social pressure, or, equivalently, small deviations result in relatively low social pressure. This is reasonable when an intermediate action is viewed similarly to a costly action. For example, in the case of FGC in Somalia, the lower-cost variant Sunna began to displace the higher-cost variant Pharaonic in the 1990s. This followed by religious leaders that Sunna was compatible with Islam. This could mean the social pressure against a small deviation like Sunna becomes small, which could be captured in our model by assuming that $\iota(d)/d$ is increasing. A women who was not cut at all, on the other hand, might still suffer ostracism from the community.[33] Another example is the case of duelling in France, where, in the nineteenth century, swords became popular again, replacing pistols and leading to a sharp fall in fatalities. Around this time, swords became viewed as an honourable, traditional way of conducting duels, and drawing a small amount of blood was considered sufficient to resolve the matter.[34]

5 Gradual escalation

The previous section analysed the dynamics of costly social norms under the inadequacy and restraint motives. When we consider the case of conspicuous consumption, an additional motive must be brought to bear, namely the desire to outdo others. A woman who wears chopines that are higher than others' may feel superior or attract particular status. Similarly, a billionaire may wish not just to own a yacht as large as other billionaires', but to own the largest yacht. We refer to this motive as *oneupmanship*.

Oneupmanship applies especially to norms of conspicuous consumption, but it may also exist to some extent in other norms. For instance, someone might be considered brave for issuing a challenge to a duel.

Let $\omega : \mathbb{R} \to \mathbb{R}_+$ be nondecreasing and such that $\omega(d) = 0$ for any $d \leq 0$. Assume that the utility of an agent playing action i in state p is now

$$u_i(p) = -c_i - \lambda \sum_{j \in A} p_j(\iota(c_j - c_i) - \omega(c_i - c_j) + \rho(c_i - c_j)). \tag{4}$$

The social utility of an agent choosing i when all other agents are choosing $j > i$ is $-\iota(c_j - c_i)$ as before. Now however, the social utility of an agent choosing i when all other agents are choosing $j < i$ is $\omega(c_i - c_j) - \rho(c_i - c_j)$. Thus ω captures the oneupmanship motive. The restraint motive is in direct conflict with oneupmanship; which is stronger may depend on the context.

Oneupmanship changes the dynamics of the model significantly. Whereas inadequacy and restraint are coordination motives, oneupmanship is an *anticoordination* motive. That is, it creates an incentive for agents to choose different actions from others. Once we introduce the oneupmanship motive, the process may not

33 See Gulesci et al. 2023 and the references therein
34 Nye 1993, 186.

converge to a norm; in fact it may cycle.

To see why, it is instructive to think about how the three forces interact: Suppose one billionaire buys a yacht in order to boast about it to others. The others may now feel inadequate, and buy yachts in order to regain status. Indeed, in order to feel superior, they may buy bigger yachts. At the same time, they may not wish to buy too large a yacht: doing so might expose them to accusations of excess or immoderation. The following example illustrates how this can lead to gradual escalation followed by collapse.

Example 2. Suppose $m = 3$, $n = 6$, $c_i = i$, and $\lambda = 1$. Suppose $\rho(d) = 0$ for all $d \in \mathbb{R}$ and

$$\iota(d) = \begin{cases} 6 & \text{if } d > 0 \\ 0 & \text{otherwise,} \end{cases} \quad \text{and} \quad \omega(d) = \begin{cases} 2 & \text{if } d > 0 \\ 0 & \text{otherwise.} \end{cases} \tag{5}$$

Suppose the process starts at p^0.

An updating agent gets 0 from staying at 0 and $-1 + \frac{2}{3}2 = \frac{1}{3}$ from switching to 1. Switching to $i > 1$ yields $-i + \frac{2}{3}2 = -i + \frac{4}{3} < \frac{1}{3}$. Hence the updating agent will switch to 1. In the new state, the agent at 1 has no incentive to switch; an agent at 0 gets $0 - \frac{1}{3}6 = -2$ from staying at 0, $-1 + \frac{1}{3}2 = -\frac{1}{3}$ from switching to 1, and $-2 + \frac{2}{3}2 = -\frac{2}{3}$ from switching to 2. Hence an agent will switch from 0 to 1. Continuing in this way, figure 3 illustrates the path of the process.

Once the process reaches the state in period 10, one of the agents at 4 has an incentive to switch to 0. To see why, note that staying at 4 yields $-4 - \frac{6}{3} = -6$, switching to 5 yields $-5 + \frac{2}{3} \approx -4.33$, and switching to 6 yields $-6 + \frac{4}{3} \approx -4.67$, whereas switching to 0 yields $0 - 6\frac{2}{3} = -4$. Once an agent has switched down to 0, the remaining agent at 4 has an incentive to follow. Finally, the agent at 5 has an incentive to switch to 1 once both other agents are at 0 (but not before).

The process is then at the same state it was at in period 2, and will continue to cycle from there on.

Note that the process in example 2 displays gradual escalation followed by sudden collapse, which matches the qualitative dynamics of norms of conspicuous consumption. In general, the processes may be significantly more complex than the example considered above and paths may not be unique, making it difficult to obtain general results. It is however possible to show that when the inadequacy and oneupmanship motives are strong enough, the process must cycle.

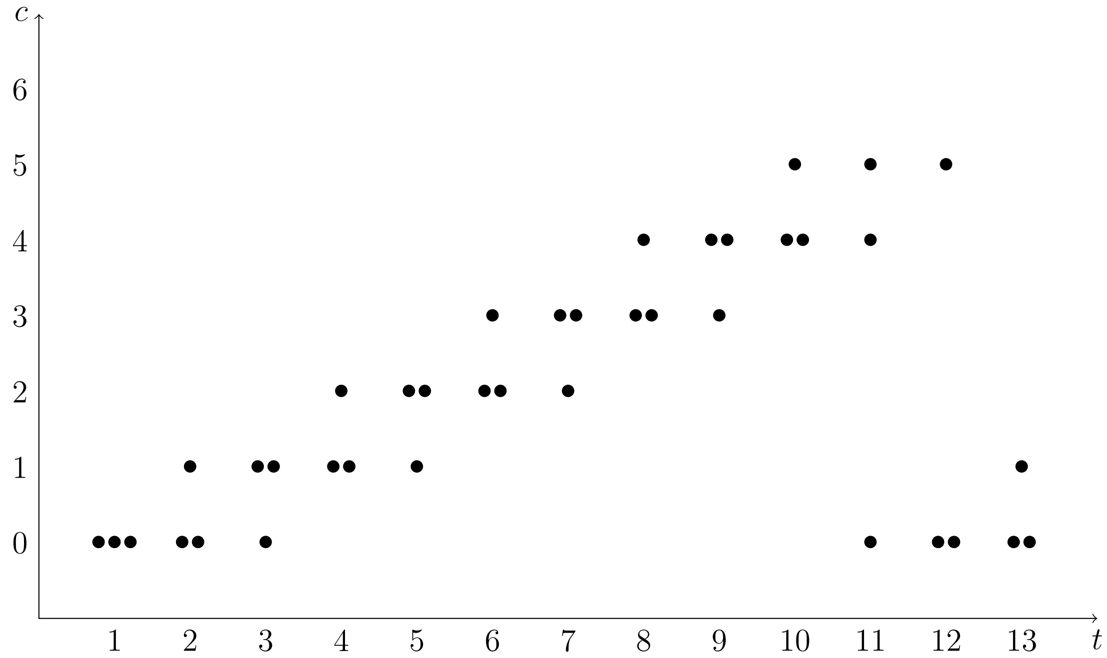


Figure 3: With the oneupmanship motive, the process can cycle.

Theorem 3. *If the cost of the costliest action is high enough, the inadequacy motive is strong enough relative to the oneupmanship motive, and the oneupmanship motive is strong enough, then the game admits no equilibria in pure strategies.*

Since the process involves agents choosing pure strategies and there is a finite number of states, the process must cycle whenever the game has no Nash equilibria in pure strategies.

The exact dynamics of the process are complex, but theorem 4 establishes conditions under which the process is characterised by gradual escalation and collapse, in a specific sense.

Theorem 4. *Assume* $\lambda\omega(d) - d$ *and* $\lambda\iota(d) - d$ *are decreasing in* d *on* $\mathbb{R}_+$*. If an agent chooses* i *in state* p*, then either* $p_i > 0$*,* $p_{i-1} > 0$*, or* $i = 0$*.*

The condition that $\lambda\omega(d) - d$ and $\lambda\iota(d) - d$ are decreasing, like the assumption that $\iota(d)/d$ is decreasing, means that social utility becomes less important relative to intrinsic utility for larger discrepancies between actions. (In fact, $\lambda\iota(d) - d$ decreasing implies $\iota(d)/d$ decreasing.)

Theorem 4 implies that the costliest action an agent can choose is at most one step costlier than the other actions chosen in the current state. Therefore if actions become costlier over time, they must do so *gradually.* In contrast, if an agent chooses switches to an action that is less costly than any other chosen action, that action must be zero. Thus the least costly action cannot decrease gradually over time – it must *collapse* all the way to zero.

6 Conclusion

Costly social norms are pervasive in society and endure because of social pressure to conform. Examples include duelling, footbinding, female genital cutting, and norms of conspicuous consumption. Such norms are rarely 'all-or-nothing'; instead, they can take on several more or less costly forms. They also display rich and varied dynamics: Some die out suddenly, as was the case for duelling in the UK and footbinding. Others transition to an intermediate norm before disappearing, as was the case for duelling in France and may be the case for FGC in Somalia. Still others, including norms of conspicuous consumption, escalate gradually before collapsing.

This paper has developed a theory of costly norms that allows for intermediate actions and predicts rich dynamics that are consistent with actual dynamics in cases where norm shifts have been documented. We focus on interim dynamics – that is, from any starting state, we ask what the next norm will be. We show that collapse will tend to occur when social pressure is relatively high for small differences. Conversely, when social pressure is relatively low for small differences, norms may transition via intermediate actions. Finally, when agents want to outdo one another, the process can follow cycles of gradual escalation followed by collapse.

A Appendix

A.1 Proof of theorem 1

Let p be the initial state; suppose it is not a norm. Let

$$\bar{u} = \max_{\{i:p_i>0\}} u_i(p) \tag{6}$$

$$\bar{A} = \arg\max_{\{i:p_i>0\}} u_i(p). \tag{7}$$

That is, $\bar{u}$ is the maximal utility at p and $\bar{A}$ is the set of actions that achieve the maximal utility. $\underline{A} = \{i : p_i > 0\} \setminus \bar{A}$ be the set of actions that are played and do not achieve the maximal utility.

We argue there is positive probability of reaching either a norm or a state with strictly higher maximal utility in at most $m-1$ periods.

First, suppose p is homogeneous. Let i be the action played. Since p is not a norm, some agent can weakly increase their payoff by switching to a best response $j \neq i$. If this strictly increases their payoff, then we're done. Suppose it leaves their payoff unchanged. Switching to $j > i$ from p^i strictly decreases the agent's payoff, so it must be the case that $j < i$ and $\iota(c_i - c_j) > 0$. Hence a second agent switching from i to j strictly increases her payoff.

Second, suppose $\bar{A}$ is not a singleton. Let $i, j \in \bar{A}$ be such that $i < j$. Then it must be the case that $\iota(c_k - c_i) > 0$ for some k such that $p_k > 0$. Hence some agent can strictly increase their payoff by switching from k to i.

Finally, suppose $\bar{A}$ is a singleton and p is not homogeneous. Let $i^* \in \bar{A}$. If there is some $i \in \underline{A}$ such that switching from i to i^* yields strictly more than $\bar{u}$, then we're done. Moreover, an agent playing $i \in \underline{A}$ can achieve at least $\bar{u}$ by switching to i^*, so if i^* is not a best response, then we're done. Therefore suppose that, for all $i \in \underline{A}$, i^* is a best response and switching to i^* yields exactly $\bar{u}$. Suppose the agents playing actions in $\underline{A}$ successively switch to i^*. The utility of i^* remains $\bar{u}$. If at any point some $j \neq i^*$ becomes a best response, then an agent can achieve strictly more than $\bar{u}$ and we're done. If not, we must reach the homogeneous state p^{i^*} in at most $m-1$ periods. Moreover, since no other action is a best response, p^{i^*} must be a norm.

We have established that for any state that isn't a norm, there is a positive probability of reaching either a norm or a state with strictly higher maximal utility in at most $m-1$ periods. Since there are finitely many states, there is a global maximum utility and a minimum increment in the maximal utility, so the maximal utility cannot continue increasing indefinitely. It follows that, from any state, there is a positive probability of reaching a norm in finite time. □

A.2 Proof of theorem 2

Let λ' be the new value of the parameter and let $v'_j(p)$ denote the utility of an agent choosing $j \in A$ in state p under the new value of the parameter.

A.2.1 An increase in λ

First, suppose $\lambda' > \lambda$. Let $j \neq i$. Since i was stable under λ, we have

$$\begin{aligned} & v_i(p^i) > v_j(p^i + e^{ij}) && (8) \\ \implies & -c_i > -c_j - \lambda\frac{m-1}{m}(\iota(c_i - c_j) + \rho(c_j - c_i)) && (9) \\ \implies & -c_i > -c_j - \lambda'\frac{m-1}{m}(\iota(c_i - c_j) + \rho(c_j - c_i)) && (10) \\ \implies & v_i'(p^i) > v_j'(p^i + e^{ij}), && (11) \end{aligned}$$

where the second implication follows from the fact that ι and rho are nonnegative.

A.2.2 A decrease in λ

Second, suppose $\lambda' < \lambda$ and i becomes unstable. By assumption, i is not stable so i is not a best response.

Consider $j > i$. Since $s(c_i - c_j) \geq 0$ and $c_j > c_i$, we have

$$\begin{aligned} & -c_i > -c_j - \lambda'\frac{m-1}{m}\rho(c_j - c_i) && (12) \\ \implies & v_i'(p^i) > v_j'(p^i + e^{ij}), && (13) \end{aligned}$$

so $j > i$ is not a best response at p^i under λ'.

Consider $j < i$. We have

$$\begin{aligned} v_j'(p^i + e^{ij}) - v_i'(p^i) &= c_i - c_j - \lambda'\frac{m-1}{m}\iota(c_i - c_j) && (14) \\ &= (c_i - c_j)\left(1 - \lambda'\frac{m-1}{m}\frac{\iota(c_i - c_j)}{c_i - c_j}\right). && (15) \end{aligned}$$

Under the assumption that $\iota(d)/d$ is decreasing on $\mathbb{R}_{++}$, the right-hand side is decreasing in $j < i$. Hence action 0 is the unique best response at p^i.

Let $l \in \{0, 1, \ldots, m-1\}$ and suppose 0 is the unique best response at $p = p^i + le^{i0}$. Consider state $p' = p^i + (l+1)e^{i0}$. Fix $j \neq 0$. If $j > i$, then

$$\begin{aligned} & v_i'(p') - v_j'(p' + e^{ij}) && (16) \\ =& c_j - c_i + \lambda'\left(\frac{l+1}{m}(\rho(c_j - c_0) - \rho(c_i - c_0)) + \frac{m-l-2}{m}\rho(c_j - c_i)\right) && (17) \\ >& 0, && (18) \end{aligned}$$

where the inequality follows from the fact that $c_j > c_i$ and s is nonnegative and nonincreasing on $\mathbb{R}^*_-$. Hence $j > i$ is not a best response at p' for an agent choosing i. Similarly,

$$v'_i(p' + e^{0i}) - v'_j(p' + e^{0j}) \tag{19}$$

$$= c_j - c_i + \lambda' \left(\frac{l}{m}(\rho(c_j - c_0) - \rho(c_i - c_0)) + \frac{m-l-1}{m}\rho(c_j - c_i) \right) \tag{20}$$

$$> 0. \tag{21}$$

Hence $j > i$ is not a best response at p' for an agent choosing 0.

Next, consider $j \leq i$. We have

$$v'_0(p' + e^{i0}) - v'_j(p' + e^{ij}) \tag{22}$$

$$= c_j - c_0 + \lambda' \left(\frac{m-l-2}{m}(\iota(c_i - c_j) - \iota(c_i - c_0)) + \frac{l+1}{m}\rho(c_j - c_0) \right) \tag{23}$$

$$= v_0(p + e^{i0}) - v_j(p + e^{ij}) + \lambda'\delta(\iota(c_i - c_0) - \iota(c_i - c_j) + \rho(c_j - c_0)), \tag{24}$$

where $\delta = 1/m$. Since 0 was the unique best response at p, we have $v'_0(p + e^{i0}) > v'_j(p + e^{ij})$. The fact that ρ is nonnegative and ι is nondecreasing implies that $\iota(c_i - c_0) - \iota(c_i - c_j) + \rho(c_j - c_0) \geq \iota(c_i - c_0) - \iota(c_i - c_j) \geq 0$. Hence $0 < j \leq i$ is not a best response for an agent choosing i.

Similarly, we have

$$v'_0(p') - v'_j(p' + e^{0j}) \tag{25}$$

$$= c_j - c_0 + \lambda' \left(\frac{m-l-1}{m}(\iota(c_i - c_j) - \iota(c_i - c_0)) + \frac{l}{m}\rho(c_j - c_0) \right) \tag{26}$$

$$= v'_0(p) - v'_j(p + e^{0j}) + \lambda'\delta(\iota(c_i - c_0) - \iota(c_i - c_j) + \rho(c_j - c_0)) \tag{27}$$

$$> 0. \tag{28}$$

Hence $0 < j \leq i$ is not a best response for an agent choosing 0.

Thus 0 is the unique best response at p' for all agents. It follows that 0 is a unique best response at $p^i + le^{i0}$, for $l = 0, 1, \ldots, m$. Hence 0 is chosen in every period, as required. $\square$

A.3 Proof of theorem 3

We begin by restating theorem 3 formally. Inequality (29) ensures that the costliest action isn't a norm; inequality (30) states that inadequacy is stronger than oneupmanship; and inequality (31) states that oneupmanship is sufficiently strong.

Note that oneupmanship needs to be sufficiently strong relative to restraint, which is intuitive since the two motives are in direct opposition to one other.

Theorem. *Suppose that*

$$c_n > \lambda\frac{m-1}{m}\iota(c_n), \tag{29}$$

$$\iota(d) > \omega(d) \text{ for all } d > 0, \text{ and} \tag{30}$$

$$\lambda\frac{m-1}{m}\omega(c_{i+1}-c_i) > c_{i+1}-c_i + \lambda\frac{m-1}{m}\rho(c_{i+1}-c_i) \text{ for each } i < n. \tag{31}$$

Then the game admits no equilibria in pure strategies.

Note that the game in example 2 satisfies the above conditions.

Suppose the conditions hold. First, consider a homogeneous state p^i, for some $i < n$. Staying at i yields $-c_i$ and switching to $i+1$ yields

$$-c_{i+1} + \lambda\frac{m-1}{m}\omega(c_{i+1}-c_i) - \lambda\frac{m-1}{m}\rho(c_{i+1}-c_i). \tag{32}$$

Hence agents have an incentive to deviate.

Second, consider p^n. Staying at n yields $-c_n$ and switching to 0 yields

$$-\lambda\frac{m-1}{m}\iota(c_n). \tag{33}$$

Hence agents have an incentive to deviate.

Third, consider an inhomogenous state p. Let i and j be actions chosen in p such that $i < j$. Seeking a contradiction, suppose both actions are best responses at p. Then we have

$$v_i(p) \geq v_j(p) + \frac{\lambda}{m}(\rho(c_j-c_i) - \omega(c_j-c_i)) \text{ and} \tag{34}$$

$$v_j(p) \geq v_i(p) + \frac{\lambda}{m}\iota(c_j-c_i). \tag{35}$$

Summing the inequalities and simplifying, we obtain

$$\omega(c_j-c_i) \geq \iota(c_j-c_i) + \rho(c_j-c_i) \tag{36}$$

$$\implies \omega(c_j-c_i) \geq \iota(c_j-c_i), \tag{37}$$

which contradicts the assumption that $\iota(d) > \omega(d)$ for all $d > 0$. Thus at least one agent has an incentive to deviate, and hence p is not an equilibrium. □

A.4 Proof of theorem 4

Suppose $j \neq 0$ is a best response for some agent playing i at p and $p_j = p_{j-1} = 0$.

Let $\eta = v_{j-1}(p + e^{i(j-1)}) - v_j(p + e^{ij})$ and $p' = p + e^{ij}$. Since $p_j = p_{j-1} = 0$ and $\rho(0) = \omega(0) = \iota(0)$, we have

$$v_{j-1}(p + e^{i(j-1)}) = -c_{j-1} - \lambda \sum_{k=1}^{j-2} p'_k \rho(c_{j-1} - c_k) + \lambda \sum_{k=1}^{j-2} p'_k \omega(c_{j-1} - c_k) - \lambda \sum_{k=j+1}^{n} p'_k \iota(c_k - c_{j-1}) \tag{38}$$

$$v_j(p + e^{ij}) = -c_j - \lambda \sum_{k=1}^{j-2} p'_k \rho(c_j - c_k) + \lambda \sum_{k=1}^{j-2} p'_k \omega(c_j - c_k) - \lambda \sum_{k=j+1}^{n} p'_k \iota(c_k - c_j). \tag{39}$$

Note that $\lambda \sum_{k=1}^{j-1} \rho(c_{j-1} - c_k) \leq \lambda \sum_{k=1}^{j-1} \rho(c_j - c_k)$ since ρ is nonnegative and nondecreasing. Hence

$$\eta \geq c_j - c_{j-1} + \lambda \sum_{k=1}^{j-2} p'_k(\omega(c_{j-1} - c_k) - \omega(c_j - c_k)) - \lambda \sum_{k=j+1}^{n} p'_k(\iota(c_k - c_{j-1}) - \iota(c_k - c_j)) \tag{40}$$

$$= \sum_{k=1}^{n} p'_k((c_j - c_k) - (c_{j-1} - c_k)) + \lambda \sum_{k=1}^{j-2} p'_k(\omega(c_{j-1} - c_k) - \omega(c_j - c_k))$$

$$- \lambda \sum_{k=j+1}^{n} p'_k(\iota(c_k - c_{j-1}) - \iota(c_k - c_j)) \tag{41}$$

$$\geq \sum_{k=1}^{j-2} p'_k((c_j - c_k) - (c_{j-1} - c_k) + \lambda(\omega(c_{j-1} - c_k) - \omega(c_j - c_k)))$$

$$+ \sum_{k=j+1}^{n} p'_k((c_j - c_k) - (c_{j-1} - c_k) - \lambda(\iota(c_k - c_{j-1}) - \iota(c_k - c_j))) \tag{42}$$

$$= \sum_{k=1}^{j-2} p'_k((\lambda\omega(c_{j-1} - c_k) - (c_{j-1} - c_k)) - (\lambda\omega(c_j - c_k) - (c_j - c_k)))$$

$$+ \sum_{k=j+1}^{n} p'_k((\lambda\iota(c_k - c_j) - (c_k - c_j)) - (\lambda\iota(c_k - c_{j-1}) - (c_k - c_{j-1}))) \tag{43}$$

$$> 0, \tag{44}$$

where the final inequality follows from the assumption that $\lambda\omega(d) - d$ and $\lambda\iota(d) - d$ are decreasing in d on $\mathbb{R}_+$.

Thus $v_{j-1}(p + e^{i(j-1)}) > v_j(p + e^{ij})$, so contradicting the assumption that j is a best response. □

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