“Is That a Gun in Your Pocket... ?” Applications for Patents and Costly Verification

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Abstract

I model a signaling game between an applicant for a profitable privilege, such as an inventor, and a decision maker empowered to grant this privilege, such as a patent examiner. Two obstacles might hinder the transmission of relevant information in that context. First, the decision maker has to exert costly effort in order to ascertain the characteristics of the candidate. Doing so, she may overlook a decisive piece of information provided by the candidate. Second, the candidate might find truthfulness too costly relative to a cheaper application strategy that involves some obfuscation. However, padded applications endogenously arise as a solution to overcome both obstacles. It is shown that padding aligns the decision maker's and the candidate's respective interests in successful communication as long as it is coupled with the decision to award the profitable right when a doubt remains on the candidate's true characteristics.

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1 Introduction

In personal relationships, the academic world, politics, and many other fields, communication is one key ingredient to success. However, over-advertising what one has to communicate often occurs. For instance, the presenter of a scheduled seminar starts teasing the potential audience with a catchy title and finishes wowing it with a nice abstract. His audience is then likely to be big and willing to carefully listen. After the seminar, three situations are possible: 1) the posted title and abstract were truly announcing valuable results, the audience understood them, communication succeeded; 2) the posted title and abstract were truly announcing valuable results, the audience did not understand them, communication failed; 3) the posted title and abstract were fraudulently announcing valuable results, the audience lost its time, communication *never* occurred. Obviously, outcome 1) is worth the presenter's advertising effort and the audience costly attention. Whether these bilateral efforts should always be encouraged depends on the costs of outcomes 2) and 3) relative to the gains of outcome 1). This article explores how the potential for *costly content padding* by a candidate – e.g. to a patent, a conference, or the opportunity to run in final elections – affects a decision maker's willingness first to understand (at some cost of his own), and second to grant the candidate.

In a given communicative relationship, several strategic features may hinder the transmission of relevant information. So far, the economic analysis has shed light on two main obstacles: asymmetric information (or equivalently "hidden knowledge") and moral–hazard–in–team. In the original example of Akerlof (1970), buyers and sellers trade in a market with two types of cars: "good" cars are worth a high amount, "lemons" are worth relatively little. Buyers are unable to distinguish between cars and therefore offer a lower price than the full price of a good car. They do so in order to insure themselves against the risk of buying a lemon. As a result of a too low price, owners of good cars opt out and the market is flooded with lemons. The economic analysis of information could not stop at this non–satisfactory market breakdown. Hence Spence's idea (1973): costly actions can be interpreted as type–revealing signals, as long as costs differ for different types. However, such a sorting condition on costs does not always exist, as it can be that the recipient of the signal does not observe it. Information transmission can nevertheless occur if, in the example of Akerlof, the buyers individually gather information about offered cars; or if internet users individually inquire for the privacy policy of their favorite web sites, and so on. Of course, looking for relevant information is costly. Dewatripont and Tirole (2005) build on this idea that information transmission involves bilateral, costly and non–observable efforts. They model communication as the output of a sender–receiver team. The sender bears costs in formulating a message and the receiver bears costs os his own in understanding it. Costs are private. The two efforts help transforming the sender's *proposal of cooperation* into hard information on which the receiver bases his (dis)agreement to cooperate. The degree to which the sender's and receiver's interests are aligned, along with the type of decision making bring about moral–hazard–in–team. Decision making is either *executive* or *supervisory*. It is *executive* whenever the receiver needs to absorb the content in order to act; it is *supervisory* whenever the receiver uses the information only to assess the merits of alternative decisions. The moral hazard issue can ultimately impede the effectiveness of communication.

My set-up builds on these contributions and further contributes to the economic comprehension of communication. It adds costly content padding[1] to the modeling of the transmission of information. Padding works as a strategic device applicants use to alter the recipient's costs of understanding. All candidates can invite a decision maker to be part of some "communicative team". More important, all candidates can pad their demand so that the arbitrator is well–disposed toward exerting effort to understand. However, the decision maker cannot immediately tell if an application is padded with wind or with hard evidence of the candidate's value. In communicative contexts where the receiver does not commit to a certain understanding effort, padded applications may function as an invitation to communicate. The present article analyzes the circumstances under which the receiver translates this padding activity into such an invitation and reacts to it by exerting understanding effort. turns it into some presentation requirements that can eventually help his screening effort.

Processing applications for patents captures this feature of a communicative relationship[2]. Hereafter, I adopt the patent lexicon: a sender is named "applicant", the receiver "examiner". Both a genuine inventor and an imitator try to convince the examiner of being worth a patent. Imitators also try because there is room for examiner's error. In the Dewatripont and Tirole set–up, there is no such fraudulent invitation to communicate. Communication either succeeds or fails, but the sender cannot mislead the receiver, nor can he alter the sender's costs of effort. In other words, Dewatripont and Tirole do not model the problem of costly content padding by different types of senders. By contrast, I allow for different types of applicants to have heterogenous productivity of their communicative efforts: only genuine inventors can certify their type. This heterogeneity is unknown to the examiner.

The economic literature generally argues that information distortion and/or retention can help a non–informed principal reducing informational rents of agents. This is indeed the main result of Maggi and Rodriguez (1995). In the present set–up, padding has two effects that have not been disentangled so far.

First, an optimistic examiner[3], who has exerted some screening effort, does not always prefer to refuse a candidacy when she cannot differentiate an application con-

[1] I equivalently use the term "obfuscation" in the paper.

[2] Answers from a survey conducted within the European Patent Office by Friebel et al. (2006) show that more than 63% of the examiners say applicants' work of better quality would "save them a lot of time" (sample size: 4200 EPO agents). On the other hand, patent information users express growing concern as Minoo Philipp (2006): "Many 'doubtful' applications are being filed and granted, increasing workload and reducing efficiency. It is a vicious cycle of inflation in numbers leading to deflation in quality".

[3] By "optimistic" I mean that the examiner has a high prior about the relative proportion of good applicants.

taining nothing but wind from an application containing hard information. Hence, the optimistic examiner has low incentives to exert any understanding effort in the first place. If applicants obfuscate their applications and if some imitators are credited the benefit of the doubt when two padded applications cannot be distinguished, then the examiner has *ex ante* stronger incentives to exert understanding effort. Successful communication becomes all the more valuable to an examiner that she bears the costs of potentially patenting an imitator. Consequently, the examiner has higher–powered incentive to understand the applications, even at a cost and even when she knows she cannot strictly refuse applications that she does not understand. Of course imitators will apply and some of them will get a grant. But this represents a second order loss compared to the first order and valuable effect of strengthening the examiner's incentive to screen in the first place.

Second, padding aligns the genuine inventor's and the examiner's incentives to communicate. It encourages good applicants to convey hard evidence of their type by raising the relative gains a genuine inventor gets from disclosing hard information. Not only do they have to convince the examiner of their willingness to communicate, hence the padding, but they also gain from successful separation from imitators.

I detail the model and describe the signaling technology in the second section. In section 3, equilibrium conditions are described in the context of costless effort of the examiner. In section 4, I discuss the main results when examination costs are introduced. Sections 5 and 6 discuss the welfare implications of the equilibrium results and compare the here adopted signaling approach to what a mechanism design approach would achieve. The seventh section concludes the article.

2 The Model

2.1 The Players

There are two players: an Applicant (hereafter A, he) and an Examiner (hereafter E, she). An applicant can be of two types, $\{L; H\}$. H is worth a grant; L is not. The examiner E is of one type only and is assumed socially benevolent.

Applicants' Actions A chooses an application a from a finite set of applications $\{a_-; a_+; \bar{a}\}$. Either type of applicant can "shirk" by sending an empty application a_- at some small cost. However, file a_- does not mean that the applicant is of type L; it certainly means that he showed bad will complying with the requirements of the application process.

Applicants' Payoffs H gets the monopoly profit $\bar{\Pi}$ from a grant, and L gets the monopoly profit $\underline{\Pi}$, where $\underline{\Pi} < \bar{\Pi}$. The profitability of a genuine invention is higher than the profitability of an imitation. Costs of filing an application are as follows:

1) $C_A(a_-)$ and $C_A(a_+)$ are the same for all applicants,

2) $C_A(a_-) < C_A(a_+) < C_A(\bar{a}|H) \ll C_A(\bar{a}|L) = \infty$.

In words, H and L bear the same costs of shirking or padding their applications "with wind". However, $C_A(\bar{a}|H)$ and $C_A(\bar{a}|L)$ differ: a bad applicant bears infinite cost for transmitting hard information. In practice, only a good applicant can certify he actually is H by choosing action $\bar{a}$.

Examiner's Actions Examiner E chooses an expertise level $e \in [0, 1]$. Ultimately, E takes the decision $x \in \{G, R\}$ to grant (G) or to refuse (R) a patent.

Examiner's Payoffs Examiner E bears expertise effort cost $C_E(e)$. The function $C_E(.)$ is increasing, convex and twice differentiable in its argument. Granting a type–H applicant yields a consumer surplus[4] $\bar{S}$, granting a type–L applicant yields a consumer surplus $\underline{S}$, and $\underline{S} < 0 < \bar{S}$. I make the further assumption that: $\underline{\Pi} + \underline{S} < 0 < \bar{\Pi} + \bar{S}$[5].

Perfect Bayesian Equilibrium A Perfect Bayesian Equilibrium (see Fudenberg and Tirole (1991)) consists of strategies and an update rule that satisfy the usual incentive compatibility and consistency conditions which I now formalize.

For a received application a and a given effort and decision pair $\{e, x\}$, I describe the updating-rule ρ as a function such that: $\rho : (a, a(e), e) \rightarrow \triangle(\{L, H\})$. Where $\triangle(\{L, H\})$ refers to the set of probability distributions on $\{L, H\}$, and $a(e)$ refers to the fine–tuned knowledge E can get on A's action thanks to her effort e.

The quadruplet $\{a; e; x; \rho\}$ is a Perfect Bayesian Equilibrium when the two following conditions hold:

1) Both the applicant and the examiner's incentive constraints are met: $\forall A \in \{L, H\}$ and $\forall a \in \{a_-; a_+; \bar{a}|A\}$, a and $(e, x|a)$ respectively solve:

$$\begin{aligned} a &\in \arg\max_a \{\rho(H|a, a(e), e)\Pi - C_A(a)|A\}, \\ e_{x=G} &\in \arg\max_e \{\rho(\bar{\Pi} + \bar{S}) + (1-\rho)(1-e)(\underline{\Pi} + \underline{S}) - C_E(e) - \rho C_A(a|H) - (1-\rho)C_A(a|L)\}, \\ e_{x=R} &\in \arg\max_e \{e\rho(\bar{\Pi} + \bar{S}) - C_E(e) - \rho C_A(a|H) - (1-\rho)C_A(a|L)\}. \end{aligned}$$

2) For any equilibrium action a, $\rho(.|a, a(e), e, x)$ is derived from Bayes' rule whenever possible. I shall make further assumptions about some out of the equilibrium path. It is required that posterior beliefs of the examiner have support on the corresponding information set.

I focus my analysis on the case of a benevolent examiner who maximizes the applicants' and consumers' joined profits. The first two following definitions attach a

[4]Consumers eventually benefit from these temporary monopolies, which trigger innovation and the supply of new products.

[5]See Table A in Appendix A for the strategic form of the game.

label to some specific strategies of an examiner and applicants. The third one defines separation in equilibrium.

Definition 1 (Rubber–stamping Strategy)**.** *An examiner adopts a rubber-stamping strategy when she grants all applications in equilibrium and refuses all out–of–equilibrium applications.*

Definition 2 (Communicative Strategies)**.** *Applicants adopt a communicative strategy when they file $\bar{a}$ demands. An examiner E adopts a communicative strategy when she exerts strictly positive effort $e > 0$.*

Definition 3 (Separation)**.** *A separating equilibrium has two different types always choosing different actions a. Furthermore, an equilibrium which would have L and H respectively filing $\{a_+; \bar{a}\}$ is said to be partially separating.*

Separation does not necessarily imply communication in this framework.

2.2 Information

E cannot sort out the filing action a_+ from the filing action $\bar{a}$ at first[6]. This correspond to the possibility of costly padding referred to in the introduction. Therefore, L can successfully pretend to be H only to the limited extent that communication may fail. The examiner's effort e helps her to further distinguish between a_+ and $\bar{a}$ when applicable.

With probability e, the examiner learns the course of action chosen by A. This course may either be a_+ or $\bar{a}$. However, only an $\bar{a}$ file provides hard information that the invention is valid. With probability $(1 - e)$, E cannot precisely tell whether the application intentionally lacks some hard evidence or that she missed this hard evidence.

Communication leads to understanding only with probability e and this event is called "successful communication". In this respect, I am more interested in analyzing an "A-E team"'s *attempt to communicate* rather than to study the determinants of *ex post* success or failure of communication[7]. When communication fails (with probability $(1 - e)$) or when "expertise paralysis" occurs (applicants pool on one action), E must take a blind decision based only on her Bayesian inference.

[6]E.g. the two files share complexity and density. Quoting the Staff Union of the EPO in the September 2004 internal document "The quality mission of the European Patent Office": "there has been a decline in the quality of incoming applications and an increasing trend for applicants to obscure their disclosure (this is particularly so for the so called 'complex applications')."

[7]See Figure 1 in Appendix A that provides a graphical description of the application–verification game under analysis. Furthermore, Figure 2 in Appendix B compares the framework under study with the Dewatripont–Tirole's framework.

3 Costless Examination: The Benchmark

As $C_E(e) = 0, \forall e \in [0,1]$, the examiner always exerts effort $e = 1$. The padding game exhibits multiplicity of perfect Bayesian equilibria. Depending on the underlying parameters $(C_A(.), \Pi, p)$, these equilibria entail either complete pooling or separation of applicants. Of course, E always grants a patent to an applicant who took action $\bar{a}$. I therefore set E's posterior belief upon reception of $\bar{a}$ as follows: $\rho(H|\bar{a}, \bar{a}, 1) = 1$, whatever the parameters' values. Hereafter, I derive the main characteristics of pooling and separating equilibria when examination is costless.

Pooling Equilibria E faces the following tradeoff: either she gives the benefit of the doubt to applicants filing a_- or a_+ and grants them, or she refuses these files. The first option can prove less costly *ex post*. This is the case if $p > \bar{p} = \frac{-(\underline{\Pi}+\underline{S})}{(\bar{\Pi}+\bar{S})-(\underline{\Pi}+\underline{S})}$. $\bar{p}$ describes the ratio of the welfare loss from granting errors $(\underline{\Pi} + \underline{S})$ relative to total welfare gains from accurate granting decision and avoided granting errors $(\bar{\Pi} + \bar{S} - (\underline{\Pi} + \underline{S}))$. When pooling, applicants H and L simply comply with E's *ex ante* filing requirements (i.e. E's expectation of As' action). They buy a "patent ticket", either cheap (a_-), or expensive (a_+), that E rubber-stamps at no cost.

Lemma 1. *If $p \geq \bar{p}$ and $\underline{\Pi} > \max\{C_A(a_-); C_A(a_+) - C_A(a_-)\}$, the padding game has a* cheap *and an* expensive *rubber–stamping equilibrium, characterized by the following strategies and beliefs*[8].

Cheap rubber–stamping *strategies: both H and L candidates file empty applications a_-; E gives applicants the benefit of the doubt and grants all patent demands; beliefs: $\rho(H|a_-, a_-, 1) = \rho(H|a_+, a_+, 1) = \rho(H|\bar{a}, \bar{a}, 1) = 1$.*

Expensive rubber–stamping *strategies: both H and L candidates file padded applications a_+; E gives applicants with padded demand the benefit of the doubt and grants all a_+ files while refusing all empty a_- demands; beliefs: $\rho(H|a_-, a_-, 1) = 0$ and $\rho(H|a_+, a_+, 1) = \rho(H|\bar{a}, \bar{a}, 1) = 1$.*

Since the examiner's effort is costless, padding costs $C_A(a_+)$ are merely burned money by applicants to meet E's lower bound expectation of what an H type should file. In this respect, the cheap rubber–stamping Pareto–dominates the expensive one when both can occur. Respective welfare levels are as follows:

$$W_c = p(\bar{\Pi} + \bar{S}) + (1-p)(\underline{\Pi} + \underline{S}) - C_A(a_-), \quad (1)$$

$$W_e = p(\bar{\Pi} + \bar{S}) + (1-p)(\underline{\Pi} + \underline{S}) - C_A(a_+). \quad (2)$$

[8] If $p = \bar{p}$, there are pooling equilibria in which E grants with positive probability. In what follows I assume that $x = G$ when $p = \bar{p}$. Giving A the benefit of the doubt minimizes costs and is credible, since E gains nothing by reneging *ex post*.

Given the assumptions on costs, it is straight forward that welfare in (1) is higher than welfare in (2).

Separating Equilibria E now faces the following tradeoff: either she follows a tough refusal policy when the applicants do not file $\bar{a}$ but merely pad their application as a_+, or she allows genuine applicants to file a_+ as long as it suffices to differentiate them from imitators.

Lemma 2. *If $p \geq \bar{p}$ and $C_A(a_-) < \underline{\Pi} < C_A(a_+) - C_A(a_-) < \bar{\Pi}$, the padding game has a* non communicative separating *equilibrium and a* cheap rubber–stamping. Cheap rubber–stamping *strategies and beliefs are identical to those described in* Lemma 1. Non communicative separation *strategies and beliefs are as follows.* Strategies*: H files a padded application a_+, L files an empty demand a_-; E grants a_+ applications and refuses a_- demands;* beliefs*: $\rho(H|a_-, a_-, 1) = 0$ and $\rho(H|a_+, a_+, 1) = \rho(H|\bar{a}, \bar{a}, 1) = 1$.*

Interestingly, in the non–communicative separation equilibrium, E does not adopt a rubber–stamping strategy. So that applicants' non–communicative strategy does not necessarily implies rubber–stamping by E.

In contrast with the case of multiple pooling equilibria (see Lemma 1), neither equilibrium obviously Pareto–dominates the other. Respective welfare levels are, in that case, as follows:

$$W_c = p(\bar{\Pi} + \bar{S}) + (1-p)(\underline{\Pi} + \underline{S}) - C_A(a_-), \quad (3)$$
$$W_{ncs} = p(\bar{\Pi} + \bar{S} - C_A(a_+)) - (1-p)C_A(a_-). \quad (4)$$

One cannot immediately rank welfare levels in (3) and (4). Additional sensitive analysis of parameters is required. If:

$$\begin{aligned} C_A(a_-) &\geqslant -\underline{\Pi}\frac{(\underline{\Pi} + \underline{S})}{(\bar{\Pi} + \bar{S})}, \\ C_A(a_+) &\leqslant \underline{\Pi}(1 - \frac{\underline{\Pi} + \underline{S}}{\bar{\Pi} + \bar{S}}), \\ (\bar{p} \leqslant)p &\leqslant \bar{\bar{p}} = \frac{C_A(a_-) - (\underline{\Pi} + \underline{S})}{C_A(a_+) - (\underline{\Pi} + \underline{S})}. \end{aligned}$$

then separation is worth encouraging and E should refuse empty a_- files. Indeed, extra padding costs born by H applicants are then less costly to society than losses from granting errors which can still occur with probability $(1-p) \geqslant (1-\bar{\bar{p}})$.

Lemma 3. *If $p < \bar{p}$ and $\bar{\Pi} > C_A(\bar{a}|H) - C_A(a_-)$, the padding game has a unique communicative separating equilibrium characterized by the following strategies and beliefs. Strategies: H files an application containing hard information $\bar{a}$, L files an empty de-*

mand a_-; E grants $\bar{a}$ applications and refuses all the others. Beliefs: $\rho(H|a_-, a_-, 1) = \rho(H|a_+, a_+, 1) = 0$ *and* $\rho(H|\bar{a}, \bar{a}, 1) = 1$.

The welfare level reached in the communicative separating equilibrium writes as follows:

$$W_{cs} = p(\bar{\Pi} + \bar{S} - C_A(\bar{a})) - (1-p)C_A(a_-). \tag{5}$$

When examination is costless, only a strict refusal policy of a_- and a_+ demands can sustain communication in equilibrium. The examiner enforces this policy only if the expected pool of H applicants is low enough. In other words, the examiner has to be pessimistic enough to commit to a strict refusal policy. This policy, in turn, encourages good applicants to produce hard information $\bar{a}$.

4 Costly Examination: Communication and Padding

An optimistic examiner ($p \geq \bar{p}$) does not always prefer to refuse uncertain demands *a posteriori*, i.e. after having exerted searching effort. When coupled with costly expertise, this optimism destroys the existence of the communicative and separating equilibrium described in Lemma 3. For low enough expected gains of imitations, L applicants do not pad their demands. This complete deterrence of bad candidates strengthens E's optimism and ultimately crowds out E's incentive to exert costly effort. Genuine inventors can then acquire a patent at cheap costs $C_A(a_+)$. Proposition 1 hereafter states that communication occurs in equilibrium if bad applicants are willing to costly pad their candidacy. Intuitively, L applicants will costly obfuscate their application in equilibrium if they can expect a grant with some positive probability. In turn, padded applications trigger the examiner's effort and balances an optimistic E's tendency to rubber–stamp all applications without exerting effort. Importantly, padding aligns the examiner's and the genuine inventor's interests in successful communication.

Proposition 1. *If* $p \geq \bar{p}$, $\bar{\Pi} > \frac{C_A(\bar{a}) - C_A(a_+)}{e^*}$ *and* $\underline{\Pi} > \frac{C_A(a_+) - C_A(a_-)}{1-e^*}$*, partial separation with communication is an equilibrium candidate of the game.* Strategies *are: H files* $\bar{a}$*, L pads his file as an* a_+ *demand; E exerts effort* $e^* = C_E'^{-1}[-(1-p)(\underline{\Pi} + \underline{S})]$*, with probability* e^* *she grants* $\bar{a}$ *applications and refuses* a_+ *demands, with probability* $(1-e^*)$ *she grants any padded demand;* beliefs *are:* $\rho(H|a_+, a_+, e^*) = 0$, $\rho(H|\bar{a}, a_+, e^*) = p$, $\rho(H|\bar{a}, \bar{a}, e^*) = 1$ *and* $\rho(H|a_-, a_-, e^*) = 0$[9].

As one could expect, an increase in E's effort has opposite effects on H and L applicants. As the probability of granting error diminishes, L's expected profit from padding diminishes as well. By contrast, H's expected benefit from hard information

[9] I arbitrarily assign this belief since the out-of-equilibrium belief cannot be computed using Bayes' rule.

disclosure increases. However, complete deterrence of bad applicants shall not be pursued if E values communication with good applicants. Indeed, $\frac{\partial e^*}{\partial p} < 0$: an increase in the expected proportion of H applicants decreases the marginal value of E's examination. The examiner is then more likely to shirk. Giving an applicant the benefit of the doubt when the examination is not conclusive (with probability $(1 - e^*)$) serves two purposes: i) it makes E responsible for her mistake and therefore willing to exert costly effort; ii) the perspective of a careful examination encourages good applicants to produce hard information. Since E grants doubtful cases, this benefit of the doubt creates incentives for L applicants to pad their demands and mix with H applicants. H's decision not to disclose costly hard information pays off only to the limited extent that E's expertise is not conclusive. E is less willing to forgive information retention by H since she costly exerts effort to communicate with him. This raises the relative gains of hard information disclosure to genuine inventors *ex ante*.

Proposition 2. *If $p \geq \bar{p}$ and $\underline{\Pi} > \max\{C_A(a_-); C_A(a_+) - C_A(a_-)\}$, there exist other equilibria, beside the partial separation with communication equilibrium described in Proposition 1. More precisely, both the cheap and expensive rubber–stamping equilibria described in Lemma 1 also exist in that case.*

Proposition 2 simply states that there always exists an equilibrium with no attempt to communicate, provided the relative proportion of good applicants is sufficiently high. In contrast to Lemma 1 of the benchmark case, the padding costs $C_A(a_+)$ can be viewed as pure money extorsion by the examiner – who does not exert understanding effort – without reducing the information gap between E and A.

5 Welfare Analysis

The present model pinpoints the impact of granting the benefit of the doubt when examination is not conclusive. It increases the respective willingness to communicate of a good applicant and an examiner. First, such a posture encourages a genuine inventor to file an (expensive) informative application since he expects a higher ability of the examiner to understand beyond the mere padding. Furthermore, the benefit of the doubt strengthens competition for a grant between a good and a bad applicants and make the former internalize potential opposition costs. This argument is in line with Caillaud and Duchêne (2006) final statement that: "improving the examination process can be very costly, and it may be better to let examiners make errors, so firms bear ex post the costs of litigation which would invalidate errors in patent issuances.". However, the authors pass by the *ex ante* increase in the value of communication for a genuine inventor. Second and more directly, the benefit of the doubt helps the examiner internalize the social costs of her errors and makes her willing to exert higher effort in equilibrium. In this framework, granting the benefit of the doubt goes hand in hand with an always more thorough expertise. This is in contrast with the Caillaud and

Duchêne's (2006) statement previously quoted. The trade off they imply between the expertise costs and the incentive power of errors on genuine inventors is not relevant in the present set–up. More than a "stick" putting a higher risk of litigation on good applicants *ex ante*, the benefit of the doubt works as a "carrot" increasing the value of successful communication *ex ante*, therefore backing–up bilateral efforts in equilibrium.

The welfare level reached in the partial separating equilibrium with communication (see Proposition1) writes as follows:

$$W_{psc} = p(\bar{\Pi} + \bar{S} - C_A(\bar{a})) + (1 - e^*)(1 - p)(\underline{\Pi} + \underline{S} - C_A(a_+)) - C_E(e^*). \quad (6)$$

Since there is multiplicity of equilibria for the same ranges of applicants' profits and costs, and examiner's prior, W_{psc} must be compared to the cheap rubber–stamping welfare level W_c (see Lemma 1)[10]. More precisely, a benevolent social planner should compare the social benefits from accurate examination (i.e. less granting errors and better understanding of the state of the art in new innovation fields) net of both the examination costs and the "burned" padding money on the one hand, with a cheaper rubber–stamping process net of more granting errors and opportunity gains from relevant information acquisition on the other hand.

In the context of patenting, it does not seem farfetched to assume that successful communication increases expected welfare. In line with Guellec and van Pottelsberghe de la Potterie (2000)'s idea that the expertise process actually increases the value of a patent, I argue that E's understanding of the true inventor's type increases the latter's expected profits, e.g. by increasing the prospective license price over his invention[11]. Therefore, true inventors are willing to spend more (by filing a well–documented and reported innovation $\bar{a}$ whose mere padding at first glance attracts E's attention) to have the examiner exert an understanding effort.

6 Implications of the result

From a normative viewpoint, the result derived in Proposition 1 does not provide tools to reach the partial separating equilibrium with communication. Proposition 1 positively characterizes conditions that support this equilibrium and provides new intuitions on the strategic communication between applicants and patent examiners. In the signaling framework adopted so far, padding triggers communication because it motivates the examiner to acquire information. This role of padding stems from two different facts: 1) an optimistic examiner cannot commit to refuse doubtful demands; 2) examination is costly. Together, these two facts crowd out an optimistic examiner's

[10]Remember that the cheap rubber–stamping equilibrium Pareto–dominates the expensive one that yields social welfare $W_e < W_c$. So that communication with padding increases social welfare if $W_{psc} \geq W_c$.

[11]Or by reducing expected litigation costs.

incentive to screen applicants at all. If all applicants obfuscate their files, it increases the expected social loss from granting errors, thus strengthening the examiner's incentive to exert effort.

Providing normative tools would require a mechanism design approach and reversing the signaling timing analyzed so far. The examiner would offer applicants a menu of "patent contracts". Applicants would self–select by choosing only one option. However, the weakness of the examiner's capacity to commit to strict refusal, hence to exert costly effort, makes this approach very uncertain. In this respect, a useful reference is Alonso and Matouschek (2008). In their paper, the authors characterize the optimal delegation set a principal commits to in order to elicit information from a biased agent. In some cases, they show that letting the agent choose within an optimally designed set of decisions is more efficient than having the principal impose his preferred decision. However, Alonso and Matouschek leave aside the thorny question of how to motivate information acquisition in the first place. The optimal design of delegation sets when both the actors' motivation and the elicitation of information matter has not been investigated in the literature. Even if I assume away examination costs (benchmark case), could the examiner commit to a patenting policy that would elicit information from applicants? In other words, could the examiner *delegate* the granting decision to better informed candidates? What would the optimal decision set look like if delegation actually appears as more efficient than unilateral decision? An instrument of delegation could be the cost of a padded application, $C_A(a_+)$.

7 Conclusion

The signaling game developed in the present paper allows to derive a new rationale for padding in a context of communication and decision making. Two reasons give padding of applications an effective role: 1) an optimistic examiner does not always prefer to refuse a candidacy when her expertise is not conclusive, hence she has too low incentive to run this costly expertise in the first place 2) granting errors are costly for both an examiner (social loss) and a true inventor (higher risk of hollow competition and/or litigation). The sending and receiving of padded applications a priori balances the lack of commitment to refuse an application by aligning the examiner's and the genuine inventor's interests in successful communication. For the time being, solutions to the welfare problem that exists when multiplicity of equilibria arises are open. The issue is crucial when one balances bilateral communication costs and the welfare loss due to sorting errors. At stake is not less than the credibility of the examination system. Such a process ought to fulfill two objectives: 1) to encourage invention, 2) to provide consumers, downstream users, competitors, with accurate and up–to–date information on innovation.

In the same manner, I do not deal with the accurate issue of the examiner's commitment to a specific level of effort. In my set–up, the examiner cares for society's best interest. However it would be more realistic to introduce a moral hazard problem between the examiner and her employer. An efficient incentive scheme could enforce a policy of strict refusal , provided that communication and its promotion are welfare–enhancing.

Another problematic relation is the potential collusion of interests that may arise between the examiner and applicants. For instance, one could think of side payments made by bad applicants to examiners. The latter would then be less demanding in terms of padding, at society's expense. In the same spirit, the relation between the risk of collusion and the degree of competition among patents' providers (e.g. of different regions) deserves further analysis. Keeping in mind the fundamental uncertainty about a patent's validity, one could intuitively guess that the risk of collusion would decrease when introducing competitive examination. A related question naturally emerges: what kind of contract would offer competing experts and based on which instruments?

Last, the signaling approach I build here could prove useful in other areas such as the strategic sharing of soft/hard information between secret intelligence, alleged nuclear threats and ultimate intervention forces. Should the International Atomic Energy Agency (IAEA) send its experts to North Korea, Japan, or Iran at potentially high costs? Should the IAEA solely rely on these countries' leaders' claims that "they do not possess military nuclear weapons. Do not bother." or that "the leak in one of our nuclear plants has been repaired and is totally under control. Do not bother", at potentially very high costs? Actors involved in these two examples exhibit a single preferred strategy over information presentation. The present signaling game would certainly be a powerful tool in terms of both outcome predictions and policy recommendations.

A The application–verification game

Figure 1: **Extensive Form of the Application–Verification Game**

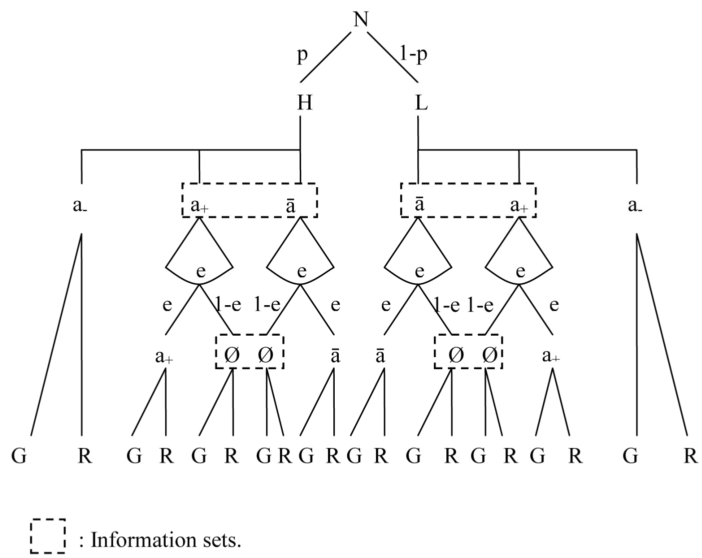


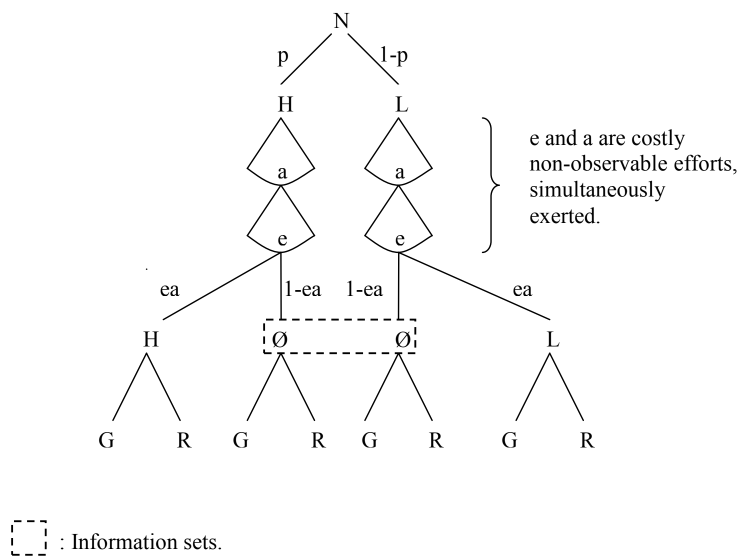
Table 1: **The Strategic Form of the Game**

	Grant (G)	Refuse (R)
H files a_-	$\bar{\Pi} - C_A(a_-); \bar{S} - C_E(e)$	$-C_A(a_-); -C_E(e)$
H files a_+	$\bar{\Pi} - C_A(a_+); \bar{S} - C_E(e)$	$-C_A(a_+); -C_E(e)$
H files $\bar{a}$	$\bar{\Pi} - C_A(\bar{a}\|H); \bar{S} - C_E(e)$	$-C_A(\bar{a}\|H); -C_E(e)$
L files a_-	$\underline{\Pi} - C_A(a_-); \underline{S} - C_E(e)$	$-C_A(a_-); -C_E(e)$
L files a_+	$\underline{\Pi} - C_A(a_+); \underline{S} - C_E(e)$	$-C_A(a_+); -C_E(e)$
L files $\bar{a}$	$\underline{\Pi} - C_A(\bar{a}\|L); \underline{S} - C_E(e)$	$-C_A(\bar{a}\|L); -C_E(e)$

B Comparison with the Dewatripont–Tirole game

Dewatripont and Tirole analyze the risk of free–riding inherent to communicative relationship. Therefore, they adopt a setting in which efforts are *absolutely* non–observable by the receiver. By contrast, I allow the receiver to assess the "front–effort" of an applicant and thus to base part of her inference on this.

Figure 2: **The Application–Verification Game à la Dewatripont–Tirole**



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