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IMPROVING WELL-BEING IN ASTROPHYSICS RESEARCH

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Abstract. Following the *Well-being in astrophysics* survey conducted in France in early 2021, to establish how astrophysics researchers experience their careers (Webb et al. 2021), we organised another national workshop to help promote well-being in (French) astrophysics research. Thanks to the participation of three professionals (sociologists, psychologists), we covered areas such as improving social interactions, identifying and avoiding burn-out, understanding and negotiating the ever present competition in academia, as well as including a discussion on the race to publish. We summarise here some of the important points discussed during the workshop.

Keywords: careers, well-being

1 Introduction

Thanks to the survey *Well-being in astrophysics*, conducted in France in early 2021 to establish how French astrophysics researchers experience their careers (Webb et al. 2021), and subsequent workshops, it has become clear that there are several areas that can be improved to enhance well-being in French astrophysics. Amongst these are improving social interactions between colleagues, with or without hierarchical relationships, which in some cases are not always optimal. Section 2 describes the dynamics of different relationships and give some examples of how to improve them. Section 3 discusses the subject of the ever present competition in academia, which manifests itself throughout a career in research, from obtaining a PhD/post-doc/permanent positions or even a promotion, to the competition for grants/funding or even telescope time, and is considerable source for anxiety, especially in the younger generations. Understanding the role of competition is important in overcoming the harm that in can cause. Section 4 considers the stress associated with the (perceived) pressure to publish. Recently Park et al. (2022) published a paper suggesting that in part due to the pressure to publish, papers are becoming less *disruptive* and thus less innovative, with fewer major break-throughs. We explore the role of publications and how to proliferate innovation and avoid the race to publish. Finally Section 5 covers other sources of stress and the downward spiral that can lead to a burnout. We discuss the origin of burnout, identify the symptoms of burn-out, and examine ways that scientist can avoid it.

2 Social interactions

Positive interactions with our peers are very important. Firstly, they allow us to collaborate and work together in a profitable fashion, but they are also important for our mental health and well-being. Research is a field which places high demands on those who work in the domain, which in turn results in a high mental load. In general, researchers are high achievers, doing everything they can to do well, but which can lead exhaustion and suffering with a poor work-life balance.

Each and everyone of us have needs (Rojzman et al. 2015). We need to feel safe, to feel a part of society, to be appreciated and to have a sense of direction or a feeling of personal achievement. If these needs are not

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met, it can lead to anxiety or apprehension of being attacked, rejected, judged or even made to feel guilty. This can lead us to behave poorly with others in an aim to protecting ourselves, by rejecting colleagues, humiliating them, guilt-tripping them or generally treating them badly. These destructive reactions can also be applied to ourselves when neither our needs nor our fears are being recognized and addressed. This interplay between needs, responses and actions has been well summarised by Rojzman et al. (2015), see also Fig. 1.

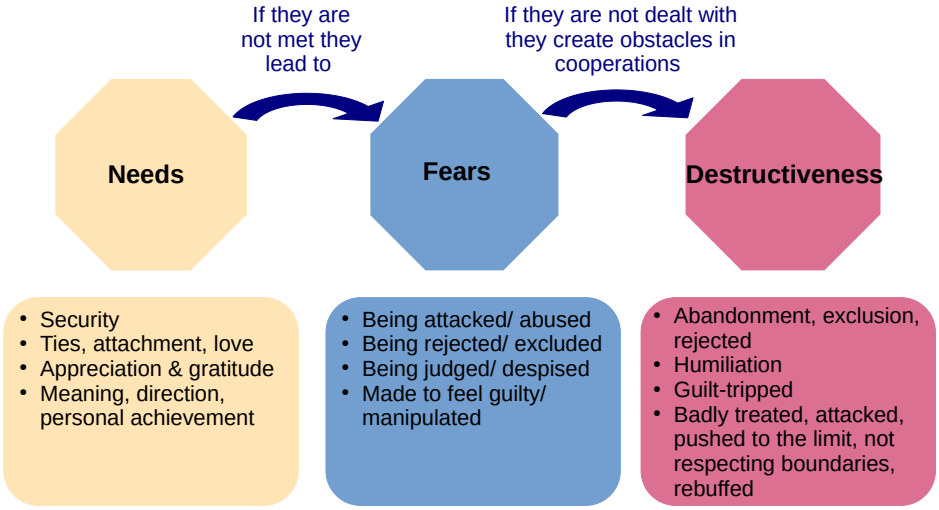

Fig. 1. Figure showing human needs, their fears if their needs are not met and the cruelty that can result if the fears are not dealt with, adapted from Rojzman et al. (2015).

Following a study of linguistic data from 200 tweets from each of nearly 130,000 Twitter users across more than 3,500 occupations, Armitage (2020) showed that researchers are less agreable than people from other professions. In order to improve our colleagues disposition and therefore improve interactions, ideally we should ensure that we acknowledge their contributions, appreciate their work and be vigilant that they are included, to ensure that their needs are being met, reducing anxiety and thus unpleasant behaviour.

During this session, a large part was dedicated to a practical session, which the vast majority of the participants found very effective. This was carried out in pairs, where participants were asked to discuss six questions, the first of which helped to serve as a reminder about what we love about our job. We were asked to consider on a personal level : What do we care most about about in our job? What is it that feeds our desire to work? What drives us or stimulates us or fascinates us in this job? What is the one thing that really speaks to us in this job? Afterwards we were asked to reflect on a moment during our professional lives that caused : intense stress or anxiety; complete exhaustion; utter helplessness. We were then asked to discuss what we felt like at that moment, what the effects were on us and what we said to ourselves. Following that we examined our fears and our apprehensions. Subsequently we were encouraged to reflect on what we needed at that moment to get through the event, what did we feel that we were missing to traverse the difficulty. We were then invited to reflect on the interplay between our needs, fears and our behaviour. Finally, we were asked to contemplate what we needed to help us at that moment. The exercise revealed, in an effective manner, the link between our emotions and behaviour, as well as allowing the participants to speak about subjects that are rarely discussed, which was also felt to be highly beneficial, see Section 3.

It should be noted that social therapy can help increase creativity and productivity and encourage collaborative efforts, important in avoiding stress related to academic careers, see Sections 3, 4 and 5. It can also help to encourage learning by example, decrease feelings of loneliness and isolation and reduce stress and anxiety. This is important for well-being and improving work output and therefore social therapy sessions maybe extremely beneficial in the workplace.

3 Competition in (astrophysics) research

Competition, real or perceived, is omni-present throughout the life of an academic. Competition exists in trying to get the highest grades, to get into the best schools, onto popular courses, in getting a PhD position and then getting post-doctoral jobs and then permanent positions. It exists well beyond that, in getting grants,

promotions, telescope/computing time, and even in getting our talks chosen to be presented at a conference, having the highest impact research and obtaining awards. A competition based system should logically lead to the best people being awarded grants or jobs. Competition can also help to prevent confirmation bias (Fang & Casadevall 2015), as different research teams work on similar research, thus all working to (dis)prove a hypothesis. It can also drive us to invest extra effort that we would not have done without the competition, and thus improve standards (e.g. DiMenichi & Tricomi 2015). But whilst competition can be a good thing, there are also drawbacks. Children rapidly perceive adult's anxiety when the children are faced with competition in school, and so they learn this anxious response to competition. Without supervision, academic competition can lead to aggression, anxiety, and frustration. We may become unduly stressed about losing status among peers, which can lead to undue focus on winning, extreme disappointment, and even low self-esteem. This competition can also lead to secrecy around results for fear of being scooped and scientists reluctant to share their work, impeding scientific progress (see e.g. Fang & Casadevall 2015, and references therein). Academic competitivity can also lead to competition to publish (see Sec. 4), reducing creativity and/or foster scientific misconduct as a result of trying to publish ever faster (e.g. Fang & Casadevall 2015).

So what can be done to help scientists overcome the stress related to competition? Leslie (2019) suggests that we should move towards collaboration rather than focussing constantly on competition. Big collaborations have produced some of the highest quality research, based on citations (e.g. Leslie 2019) and there have been calls for the Nobel Prize to be altered so that teams of researchers can be recognised, rather than the current maximum of three scientists, to take into account the way that research is moving towards large collaborations (Leslie 2019). In this way some of the stress associated with research is reduced, see Section 5, still allowing high class research to be done. Other things that can help overcome competition related stress is to talk about it, normalising it and making it easier to break-away from negative thoughts related to competition. This can also help us to create a connection with our peers (see Section 5). Finally scientists should provide support to their colleagues to help prepare for competition, encouraging the candidate and providing information on how to succeed, to ease the process and allow them to be more successful.

4 The publication race

One area of (astrophysics) research that can cause significant stress is the race to publish. Increasingly, publication rate has become one of the measures to evaluate researchers and projects, which can be at the origin of the pressure felt by researchers. However, not only does this lead to a very high volume of papers published per year, and therefore a large body of literature to keep up with, adding to the general research workload, it has been proposed that this pressure to publish may be inhibiting innovation (Park et al. 2022). The authors carried out a study using data from 45 million papers and 3.9 million patents from six large-scale datasets spanning six decades. The study used a new quantitative metric—the CD index—that characterises how papers and patents change networks of citations. They found that papers and patents are increasingly less likely to break with the past in ways that push science and technology in new directions. Park et al. (2022) state that this decline represents a shift in science and technology, that reinforces concerns about slowing innovative activity. They attribute this trend in part to reliance on a narrower set of existing knowledge, due to difficulties in following the vast number of papers published today. Whilst this paper has received some criticism concerning the metric and the methods, they are not the first people to address the problem and other authors have suggested that the competitivity in science can also reduce creativity e.g. Fang & Casadevall (2015). Park et al. (2022) also propose some interesting recommendations to improve creativity. They suggest that researchers should be encouraged to read widely, therefore sufficient time should be allocated to keep up with the rapidly expanding knowledge frontier, so universities (and other organisations) should forgo the focus on quantity, and instead reward research quality. Further, agencies should invest in riskier and longer-term individual awards that support careers and not specific projects, thus moving away from the publish or perish culture.

Whilst these actions maybe difficult to put into place in their entirety, it should be noted that in France the *High Council for the Evaluation of Research and Higher Education* (HCERES), the *French National Agency for Research* (ANR), the *Presidents of the French Universities* (CPU) and the *National Centre for Scientific Research* (CNRS) have all signed the San Francisco declaration (Declaration On Research Assessment - DORA) which states that there are many ways to contribute to our knowledge base and signatories are comitted to evaluating the quality and impact of new knowledge. This means that the publication of code, databases, etc as well as the contribution to community activities and scientific integrity should also be used in the evaluation of scientists. This means that work that is already being done will now be valued and it may help to relieve

some of the pressure felt and in some way improve the quality and impact of new science. Further, as noted in Sec. 3, a move towards collaborative science may also hold the key to reducing the publish or perish culture.

5 Burnout and how to avoid it

Burnout is rife in academia. In a recent online *Nature* poll, which ran from 7 to 15 November 2022, 75% of 1748 researchers from all career stages that replied to the survey, said that they had reduced their work hours since March 2020 (Forrester 2023). Of these 1311, 67% stated that the reason for this cut-back was that they felt burnt out. This amounts to 50% of the researchers responding to the survey. Whilst there are obviously biasses in who replied to the survey, this is a significant proportion of researchers.

Burnout is a state of exhaustion that affects you emotionally, physically, and mentally. Its origin lies in excessive and prolonged stress and can happen when you feel overwhelmed, emotionally drained, and unable to meet continual demands. If the stress continues, you can lose the interest and motivation that led you to take on the task initially. Therefore it is important to tackle the initial stress, with an aim to avoiding burnout.

There are numerous causes of stress, common ones are work, finances, relationships, parenting and day-to-day inconveniences. Stress can trigger the body's response to a perceived threat or danger, known as the fight-or-flight response. This causes hormones like adrenaline and cortisol to be released, which lead to changes in nervous functions, giving the body a burst of energy and strength. Once the stress is removed, the body returns to functionning normally, via the relaxation response. However, if the stress does not go away, remaining in the fight-or-flight state can cause damage to the body. Further, stress can also cause us to take up unhealthy habits, that could have a negative effect on health as well.

Stress affects people differently. It can cause behavioural changes in some, cognitive differences in others, emotional changes, physical effects or all of these, with the manifestation of many different symptoms (American Psychiatric Association 2013), indicated in the following paragraphs. Behavioral changes that can be signs of stress include :

- changes in eating
- clumsiness/forgetfulness
- not taking breaks
- working long hours
- functioning on 'auto-pilot'
- absenteeism
- withdrawal from others
- indecisiveness
- enhances alcohol/nicotine/ coffee intake
- temper outbursts
- avoiding things
- presenteeism
- rushing around
- over-checking
- reduced productivity
- poor self-care
- procrastinating
- reduced focus

Cognitive differences that can be signs of stress include 'thoughts that race', worrying, hopelessness, being over critical and over-ruminating. Typical thoughts include, "This is too much", "I can't cope", "They'll think badly of me", "This won't change", "I should be able to cope", "I must get this done", "I haven't got time".

Emotional changes that can be signs of stress include:

- irritability
- restlessness
- feeling overwhelmed
- unhappiness
- mood swings
- anxiousness
- often upset
- feeling overwhelmed
- feeling 'stuck in a rut'
- resentfulness
- tension in the body
- angriness
- feeling demotivated
- becoming disintrested

Physical signs of stress include:

- headaches
- nausea
- breathlessness
- blurred vision
- lump in your throat
- change in appetite
- muscle tension
- sweating
- shakiness
- dry mouth
- tingling feelings
- aches
- digestive problems
- diziness
- heart palpitations
- cold
- numbness
- pains

Stress can be either external, e.g. due to demands from work, see Fig. 2, or internal, when we become proccupied with thoughts such as memories, thoughts about the future, ideas about oneself, etc, see Fig. 3. These stresses have one of two responses, either 'eustress', which uses psychological and physical resources so that an objective can be reached and 'distress' that continues to use the resources even after the stress goes away, until the resources are depleted, leaving the individual exhausted (Lazarus 1966).

Fig. 2. Figure showing different types of external stressors, credit: contactÜ (`https://www.contactu.it/`).

Fig. 3. Figure showing different types of internal stressors, credit: contactÜ (`https://www.contactu.it/`).

Work-related stress is becoming more widely recognised, where many of the external stressors, see Fig. 2, can be present in the work place. Further, academics are often perfectionists (Levine 2008), a personality trait that can also favour stress, see Fig. 3. Hyper competitive work cultures (see Sec. 3), a lack of social support and a fear of losing ones job can make us feel like we need to sacrifice our well-being to succeed. This can lead to a vicious circle where work pressure, emotional demands and work-home conflicts can lead to exhaustion, which will reduce performance and our ability to rely on resources from our job (such as colleague support, team cohesion, supervisor support, etc) and increase our cynicism and therefore further decrease our job performance. Identifying your personal resources in work is essential to keeping a good balance. Identifying colleagues that you feel provide support and keeping regular contact with them, either by meeting for coffee, lunch or afterwork, or participating in team cohesion activities, or by reaching out to a supervisor, are all good resources to draw on to fight against stress caused from work, for example.

As we showed in Webb et al. (2021), 199 out of 276 respondents to the French National survey on well-being in astronomy stated that they work in excess of 40 hours per week and 88 out of 276 work in excess of 50 hours per week. Overwork is a significant factor in stress and it can be further amplified by short-term contracts that lack stability or security, accumulating managerial and supervisory tasks that significantly increase the workload without changing job title or salary and a lack of clarity about career opportunities and what is required to achieve a stable position. This overwork is one of the major factors in job burnout. Job burnout is defined as a result of chronic workplace stress that has not been successfully managed, and is characterised by:

1. exhaustion (feelings of energy depletion)
2. cynicism (increased mental distance from one's work and negativism related to one's work)
3. professional efficacy (a sense of ineffectiveness and lack of accomplishment)

Signs of a burnout include physical signs, including insomnia, headaches, pain and chronic tiredness. Psychological signs include depression, low self-esteem, anger and cynicism. Finally, behavioural manifestations of a burnout include absences at work, being late to work and isolating from colleagues. Whilst stress is the factor that can lead to burnout, it does not need to be the outcome. Burnout occurs when the action (fight-or-flight phase) triggered by the stress becomes continual and there is no relief phase. Then those suffering from stress are more prone to losing their coping resources and which stops them from reaching the relief (relaxing) phase. There are therefore significant differences between stress and burnout, see Table 5.

So how can we avoid burnout? There are several factors that can help protect us. As indicated above, we should develop social and emotional support from colleagues and supervisors. We must practice self-care, in order to achieve high levels of productivity and performance, and we must learn to know ourselves better,

Stress	Burnout
• Energetic, focussed	• Exhausted, fatigued
• Emotionally involved	• Emotionally drained
• Dynamic	• Detached and helpless
• Prone to anxiety disorders	• Prone to depressive disorders

Table 1. Comparison of the characteristics of stress and burnout.

manage our time, and find a safe space. Finally, it is important to choose which battles should be fought and when to let something go.

There are six steps that can be taken to avoid work-related burnout. First, make your own health a priority. Taking care of yourself is not an indulgent luxury, it is a matter of self-preservation. It is essential to find activities that can help you destress, it could be reading a book, going for a drink with friends, doing a sport that you enjoy, doing crafts, gardening, etc. Then it is essential to devote 20 minutes of the day to the activity(ies) that you enjoy, that stimulate the mind and body by activating other neural circuits and increase oxytocin production. Secondly, work on keeping stress levels down within the workplace with other colleagues who would like to do the same. This is helpful for the group but will also keep you accountable for taking care of yourself. Thirdly, also within the work place, recognise, both inwardly and publicly, saying things like "all of us are doing the best we can with the resources we have been given." In this way you are creating a psychologically safe place for yourself and others. Fourth, set a good example within the work place. If you are running from meeting to meeting and don't have enough time in the day to breathe, what message does that send? When colleagues are completely overwhelmed, you can encourage them to take regular breaks, to rest and rejuvenate and disconnect from work. Fifth, a common symptom (and cause) of job-related burnout is a disconnection between a person's values and the work they are doing. It is easy to forget what drew you to your career and your organization in the first place. When people have shared values and a connection, they are more likely to feel positively about their work. Discussions and team builiding activities can be a way to foster shared values and a connection to each other. Finally, as explained above, constant stress can lead to poor performance, which can lead to more stress and a downwards spiral. If you are aware that you or your colleagues are suffering in this way, it is time to talk to your supervisor, project manager, or other hierarchy and explain that without sufficient time to rest, you or your colleagues may no longer be able to continue, which would be detrimental to the work to be done.

These steps can help to improve well-being. However, if stress strongly affects your life, you should seek help from a mental health professional. A psychologist has the tools to support you and provide you with strategies to better manage states of stress. Don't wait to burn out before taking action.

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